PRE OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY

Dissertation submitted to

THE TAMIL NADU DR.M.G.R MEDICAL UNIVERSITY

In fulfilment of the regulations for the award of the degree

M.S. GENERAL SURGERY

DEPARTMENT OF GENERAL SURGERY
PSG INSTITUTE OF MEDICAL SCIENCES & RESEARCH
THE TAMIL NADU DR.M.G.R MEDICAL UNIVERSITY
CHENNAI, TAMIL NADU

APRIL 2015

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GUIDE: DR. RAJESH KUMAR. S

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CHENNAI, TAMIL NADU

APRIL 2015

CERTIFICATE

This is to certify that the thesis entitled **"PRE OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY"** is a bonafide work of **Dr. YAMINI PRIYADARSHINI ADUSUMILLI** done under the direct guidance and supervision of **Dr. RAJESH KUMAR.S** in the Department of GENERAL SURGERY, PSG Institute of Medical Sciences and Research, Coimbatore in fulfilment of the regulations of DR. MGR Medical University for the award of M.S degree in GENERAL SURGERY

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DR. S.RAMALINGAM
Principal

DECLARATION

I hereby declare that this dissertation entitled **PRE OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY** was prepared by me under the direct guidance and supervision of my Professor **Dr. RAJESH KUMAR. S,** in PSG Institute of Medical Sciences & Research, Coimbatore.

This dissertation is submitted to the Tamil Nadu DR. MGR Medical University in fulfilment of the University regulations for the award of MS Degree in GENERAL SURGERY. This dissertation has not been submitted for the award of any other Degree or Diploma.

Dr. Yamini Priyadarshini Adusumilli

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This is to certify that the thesis entitled **"PRE OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY"** is a bonafide work of **Dr.Yamini Priyadarshini Adusumilli** done under my direct guidance and supervision in the Department of GENERAL SURGERY, in PSG Institute of Medical Sciences and Research, Coimbatore in fulfilment of the regulations of DR. MGR Medical University for the award of M.S degree in GENERAL SURGERY

DR. RAJESH KUMAR. S

Professor

Dept. of GENERAL SURGERY

CERTIFICATE BY THE H.O.D. AND PRINCIPAL

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Dr.S.Prem kumar
Professor and HOD of General Surgery

Dr.Ramalingam
Principal

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To
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Postgraduate
Department of General Surgery
PSG IMS & R
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The Institutional Human Ethics Committee, PSG IMS & R, Coimbatore -4, has reviewed your proposal on March 7, 2014 in its expedited review meeting held at IHEC Secretariat, PSG IMS&R, between 10.00 am and 11.00 am, and discussed your study proposal entitled:

"Pre-operative prediction of difficult laparoscopic cholecystectomy"

The following documents were received for review:

1. Duly filled application form
2. Proposal
3. Informed Consent Forms
4. Data Collection Tool
5. CV
6. Budget

After due consideration, the Committee has decided to approve the study.

The members who attended the meeting at which your study proposal was discussed are as follows:

Name	Qualification	Responsibility in IHEC	Gender	Affiliation to the Institution Yes/No	Present at the meeting Yes/No
Dr P Sathyan	DO, DNB	Clinician, Chairperson	Male	No	Yes
Dr S Bhuvaneshwari	M.D	Clinical Pharmacologist Member - Secretary	Female	Yes	Yes
Dr Sudha Ramalingam	M.D	Epidemiologist Alt. Member - Secretary	Female	Yes	Yes
Dr Y S Sivan	Ph D	Member –Social Scientist	Male	Yes	Yes
Dr D Vijaya	Ph D	Member – Basic Scientist	Female	Yes	Yes

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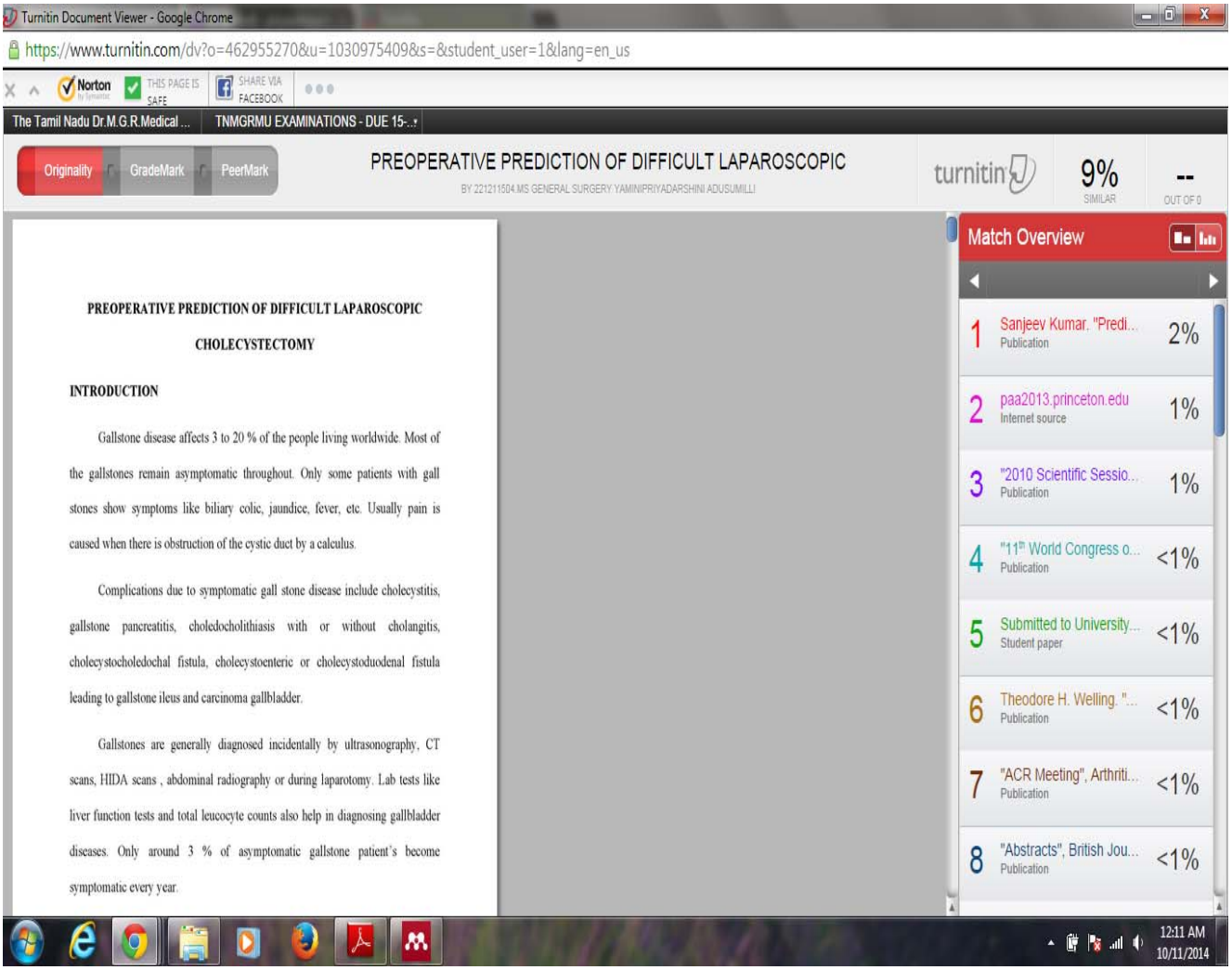
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PREOPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC
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INTRODUCTION
Gallstone disease affects 3 to 20 % of the people living worldwide. Most of the gallstones remain asymptomatic throughout. Only some patients with gall stones show symptoms like biliary colic, jaundice, fever, etc. Usually pain is caused when there is obstruction of the cystic duct by a calculus.
Complications due to symptomatic gall stone disease include cholecystitis, gallstone pancreatitis, choledocholithiasis with or without cholangitis, cholecystocholedochal fistula, cholecystoenteric or cholecystoduodenal fistula leading to gallstone ileus and carcinoma gallbladder.
Gallstones are generally diagnosed incidentally by ultrasonography, CT scans, HIDA scans , abdominal radiography or during laparotomy. Lab tests like liver function tests and total leucocyte counts also help in diagnosing gallbladder diseases. Only around 3 % of asymptomatic gallstone patient's become symptomatic every year.
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CONTENTS

PREOPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY

ABSTRACT

INTRODUCTION

Gall stone disease affects 3 to 20 % of the people living worldwide. Most of the gallstones remain asymptomatic throughout. Only some patients with gall stones show symptoms like biliary colic, jaundice, fever, etc. Usually pain is caused when there is obstruction of the cystic duct by a calculus. Gallbladder removal (Cholecystectomy) is the choice of treatment for all gallbladder diseases which are symptomatic and asymptomatic, unless the patient have increased risk to undergo surgery under general anesthesia. Among cholecystectomies, laparoscopic procedure is accepted widely as the gold standard procedure of choice. Laparoscopic cholecystectomy since its introduction has revolutionized minimally invasive surgery within a short period of twenty years. Laparoscopic cholecystectomy have various advantages like decreased morbidity, decreased stay in hospital, better cosmesis and short time for recovery.

However not all laparoscopic cholecystectomies can be finished the same way, conversion to open cholecystectomy is required in some patients. Among all the laparoscopic cholecystectomies performed worldwide 3 to 10 % need conversion to open cholecystectomy. Various factors are responsible for the conversion of laparoscopic to open cholecystectomy like in cases of acute cholecystitis, anatomic anomalies, massive fibrosis, old age, male gender,

history of upper abdominal surgeries and pancreatitis , lack of appropriate laparoscopic instruments, gallbladder wall thickness of more than 3mm, presence of pericholecystic fluid, intra operative complications like uncontrolled bleeding, injury to the internal organs. Previous conducted studies predicted the conversion of laparoscopic to open cholecystectomy using various scoring systems, but the scoring systems were not been extensively incorporated into surgical practice due to various reasons. In this study we will assess these pre operative risk factors and their correlation to the difficulty in laparoscopic cholecystectomy.

AIM of the study: To access the preoperative predictability of difficult laparoscopic cholecystectomy based on the following predictors like age more than or equal to 50 years, BMI more than or equal to 30 kg / sq.m, male gender, past history of acute cholecystitis or pancreatitis, past history of upper abdominal surgery, gallbladder wall thickness more than or equal to 3mm, presence of pericholecystic fluid, total WBC counts more than or equal to 10,000 cells/ cumm.

Study area: Department of General Surgery, PSG Hospitals

Study period: March 2014 to September 2014.

Methodology: All the patients above 18 years, who underwent cholecystectomy for symptomatic gallbladder disease were included in the study. It is a

prospective observational study. History and clinical examination was done in all patients. Ultrasound abdomen and routine blood investigations were done in all the patients. Following variables – male Gender, Age ≥ 65 yrs, BMI ≥ 30, Past history of cholecystitis , pancreatitis and history of upper abdominal surgeries, Total WBC counts >10000 cells/cumm, Presence of gallbladder wall thickness ≥3 mm and pericholecystic fluid collection. Difficult laparoscopic cholecystectomy was assessed in terms of duration of surgery in minutes. Analysis of various preoperative risk factors and their relation to the outcome variables was performed using t test. P- value of < 0.05 is considered as significant.

Results: significant predictive factors for difficult laparoscopic cholecystectomy were gall bladder wall thickness ≥3mm, WBC count ≥ 10000cells/cumm, presence of pericholecystic fluid collection.

Conclusions: Preoperative findings of Gallbladder wall thickness more than or equal to 3mm, total WBC count more than or equal to 10,000 cells/cu.mm and presence of peri cholecystic fluid collection can help in the prediction of difficult laparoscopic cholecystectomy. Other factors like old age (≥ 65 years), male gender , past history of cholecystitis and pancreatitis, history of upper abdominal surgeries and BMI ≥ 30 were not helpful in predicting difficult laparoscopic cholecystectomy preoperatively.

Key words: Gall bladder, laparoscopic cholecystectomy, open cholecystectomy, difficult laparoscopic cholecystectomy.

INTRODUCTION

Gallstone disease affects 3 to 20 % of the people living worldwide. Most of the gallstones remain asymptomatic throughout. Only some patients with gall stones show symptoms like biliary colic, jaundice, fever, etc. Usually pain is caused when there is obstruction of the cystic duct by a calculus[1].

Complications due to symptomatic gall stone disease include cholecystitis, gallstone pancreatitis, choledocholithiasis with or without cholangitis, cholecystocholedochal fistula, cholecystoenteric or cholecystoduodenal fistula leading to gallstone ileus and carcinoma gallbladder[1,2].

Gallstones are generally diagnosed incidentally by ultrasonography, CT scans, HIDA scans , abdominal radiography or during laparotomy. Lab tests like liver function tests and total leucocyte counts also help in diagnosing gallbladder diseases. Only around 3 % of asymptomatic gallstone patient's become symptomatic every year[1].

Several trials for medical treatment of gallstones remained unsuccessful . Some of the medical treatments include contact dissolution in which gallbladder is cannulated and an organic solvent is infused, oral bile salt therapy and extracorporeal shock wave lithotripsy.

As the recurrence rates are pretty much high, in 50 % patients who underwent dissolution therapies, they are no longer used for the treatment of gallstone disease. But extracorporeal shock wave lithotripsy proved beneficial in some patient's having single gallstone of size between 0.5 – 2 cm. The recurrence rates are also quite low , around 20 % in these patients[1,2].

Gallbladder removal (Cholecystectomy) is the choice of treatment for all gallbladder diseases which are symptomatic and asymptomatic, unless the patient have increased risk to undergo surgery under general anesthesia. Among cholecystectomies, laparoscopic procedure is accepted widely as the gold standard procedure of choice. Laparoscopic cholecystectomy since its introduction has revolutionized minimally invasive surgery within a short period of twenty years[1].

First cholecystectomy was performed in 1882. A century later in 1985 the first laparoscopic cholecystectomy was performed. Since then cholecystectomy has undergone many changes like invention of laparoscopic procedure, single port laparoscopic cholecystectomy to performing robot assisted cholecystectomy[3].

With increasing experience gained by the surgeons in this procedure, they started accepting cases which are more challenging and patients who are at high risk , leading to increased complication rates

and soo the rate of conversion to open cholecystectomy. Among all the laparoscopic cholecystectomies performed worldwide 3 to 10 % need conversion to open cholecystectomy[4,5].

Conventionally laparoscopic procedure is done in all cases if it's not contra-indicated. Laparoscopic cholecystectomy have various advantages like decreased morbidity, decreased stay in hospital, better cosmesis and short time for recovery. However not all laparoscopic cholecystectomies can be finished the same way , conversion to open cholecystectomy is required in some patient's[1,2,6].

Various factors are responsible for the conversion of laparoscopic to open cholecystectomy like in cases of acute cholecystitis, anatomic anomalies, massive fibrosis, old age, male gender, history of upper abdominal surgeries and pancreatitis , lack of appropriate laparoscopic instruments, gallbladder wall thickness of more than 3mm, presence of pericholecystic fluid, intraoperative complications like uncontrolled bleeding, injury to the internal organs[4,5,7].

But conversion from laparoscopic to open cholecystectomy involves it's own complications like increased chances of surgical site and respiratory infections, prolonged hospital stay. So, certain studies were performed to predict the preoperative prediction of difficult

laparoscopic cholecystectomy and to predict the conversion from laparoscopic to open cholecystectomy[4,8,9].

The ability to correctly find out the individual patient's risk responsible for conversion to open cholecystectomy based on the preoperative details can help in more appropriate preparation of the patient, improved efficiency and timing of operating room, prior preparation due to anticipation of difficulty, proper instructioning to the assistant, betterment of patient safety by decreasing the time for conversion[4,5].

Previous conducted studies predicted the conversion of laparoscopic to open cholecystectomy using various scoring systems, but the scoring systems were not been extensively incorporated into surgical practice due to various reasons.

AIMS

To access the preoperative predictability of difficult laparoscopic cholecystectomy based on the following predictors

- age more than or equal to 65 years.
- BMI more than or equal to 30 kg / sq.m
- male gender
- past history of acute cholecystitis or pancreatitis
- past history of upper abdominal surgery
- gallbladder wall thickness more than or equal to 3mm
- presence of pericholecystic fluid
- total WBC count more than or equal to 10,000

MATERIALS AND METHODS

The study was conducted in the department of General Surgery, PSG Hospitals between March 2014 to September 2014.

INCLUSION CRITERIA

Patients above 18 years with symptomatic gallbladder disease

EXCLUSION CRITERIA

Patients with gallbladder carcinoma

All the patients above 18 years, who underwent cholecystectomy for symptomatic gallbladder disease were included in the study.

It is a prospective observational study.

Patients were admitted one or two days prior to the surgery, complete history was taken and systemic examination done.

Ultrasound abdomen and routine blood investigations were done in all the patients.

DEFINITION OF VARIABLES –

1. INDEPENDENT VARIABLES –

a. Characteristics of the patients - Gender, Age, BMI were used. Out of which age and BMI were evaluated as continuous variables.BMI of more than or equal to 30 were considered as obese individuals.

b. History – Past history of cholecystitis , pancreatitis and history of upper abdominal surgeries.

c. Lab data – Complete blood counts (Total WBC count)

d. Ultrasound abdomen Findings – Presence of gallbladder wall thickness (thick - more than or equal to 3 mm vs less than 3 mm) and pericholecystic fluid collection.

2. OUTCOME VARIABLES –

Difficult laparoscopic cholecystectomy was assessed in terms of duration of surgery in minutes. It defined as the time taken from Veress needle insertion to closure of port sites. It was evaluated as continuous variable.

STATISTICAL ANALYSIS

Analysis of various preoperative risk factors and their relation to the outcome variables was performed using t test. P- value of < 0.05 is considered as significant .

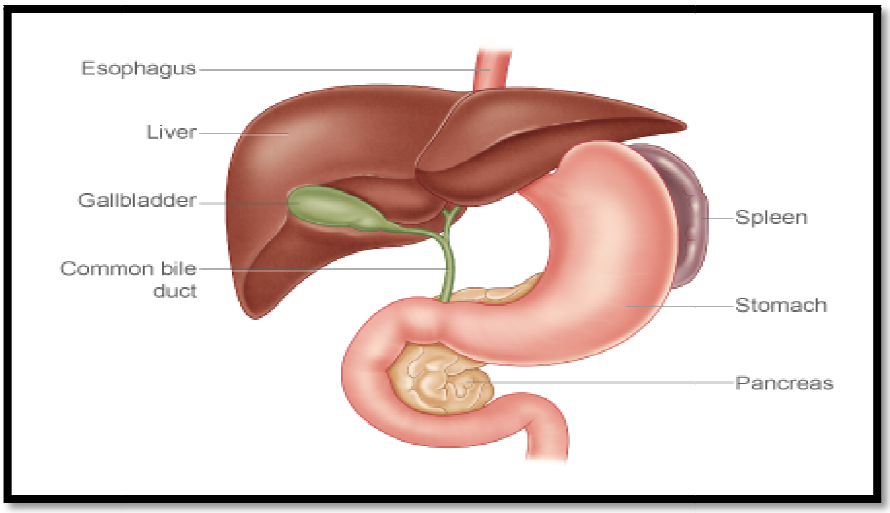
REVIEW OF LITERATURE

ANATOMY OF THE GALL BLADDER & BILIARY DUCTS

GALLBLADDER -

The gallbladder lies on visceral surface of liver in the fossa for the gallbladder (main liver scissura) at the junction of right & left parts of liver. It is a pear shaped structure which can hold 35 to 50 ml of bile(FIGURE 1). It acts as a bile concentrator & its reservoir. Its length is 7.5 to 10cms. The gallbladder is attached to the liver by connective tissue of the fibrous capsule of the liver[1,6].

FIGURE 1: Location of gall bladder



The anatomical parts of gallbladder are Fundus, Body (corpus) & Neck[6,10].

FUNDUS -

The fundus is rounded & widest end of gallbladder, which crosses the margin of the liver. Peritoneum completely surrounds the fundus. It appears as a Phrygian cap.

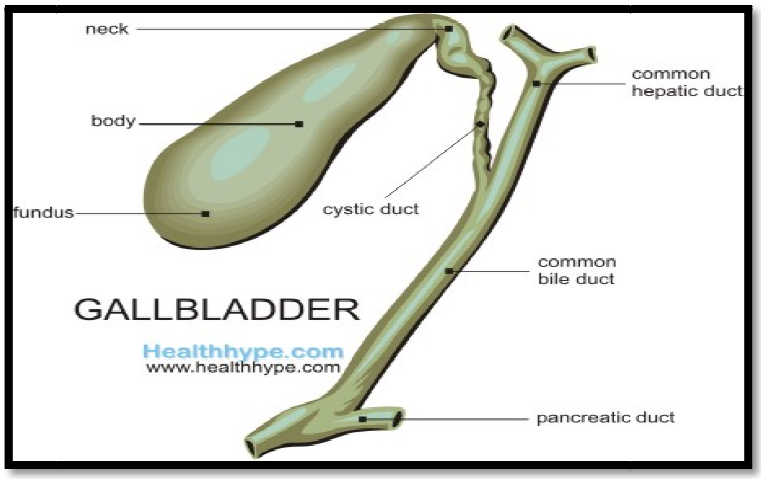
BODY -

It lies between fundus and neck. It is the main storage area of bile. It is attached to the visceral surface of liver. Body tapers into neck.

NECK -

Funnel shaped and opens into cystic duct. A distended mucosal fold near the neck of gallbladder is called Haartman's pouch.

Figure 2: Parts of gall bladder



Histologically the GB consists of four layers, with innermost layer being the mucosa followed by sub mucosa, muscularis and the

outermost being the serosa. The mucosa is lined by simple columnar epithelium that have microvilli on the luminal side. These microvilli aid in the increase of the surface area and help in concentrating the bile by absorbing the water. In the layer of muscularis, the muscles are arranged in a criss cross manner which helps in contraction of the GB.

RELATIONS -

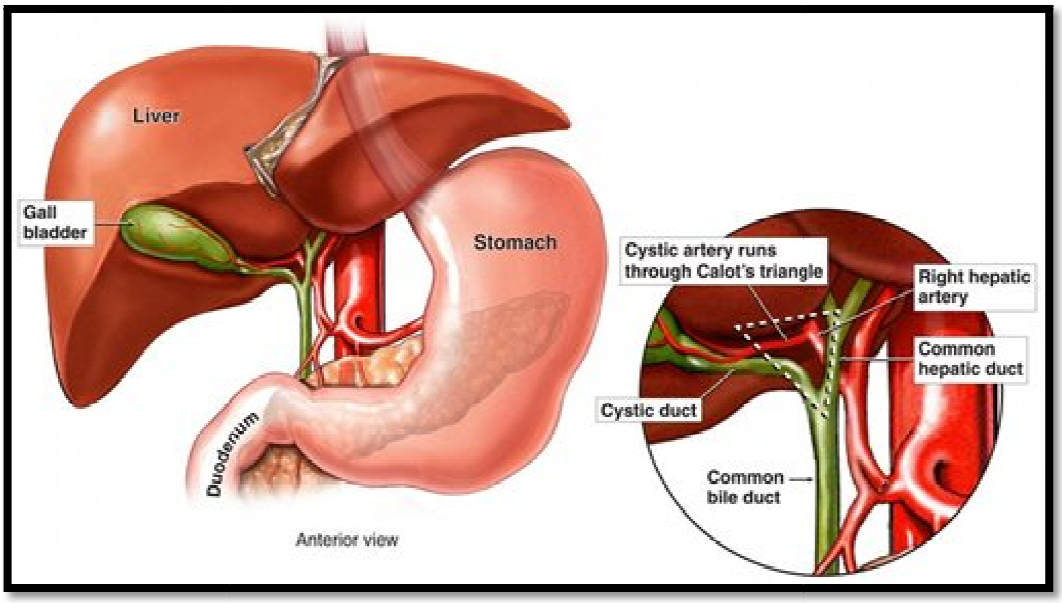
1) Anterior : Anterior abdominal wall & visceral surface of liver
2) Posterior : Transverse part of colon & first two parts of duodenum

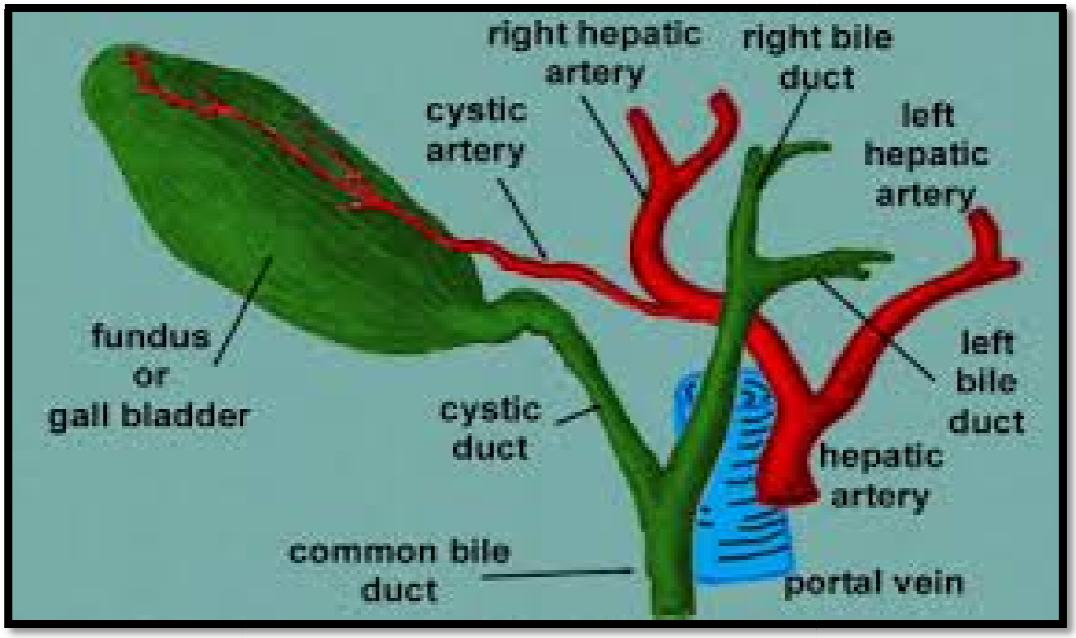
BLOOD SUPPLY-

1. ARTERIAL SUPPLY -

Cystic artery, a branch of right hepatic artery supplies the gallbladder. Cystic artery lies in Triangle of Calot or Hepatocystic triangle (borders are cystic duct, common hepatic duct & liver margin)

Figure 3: Blood supply





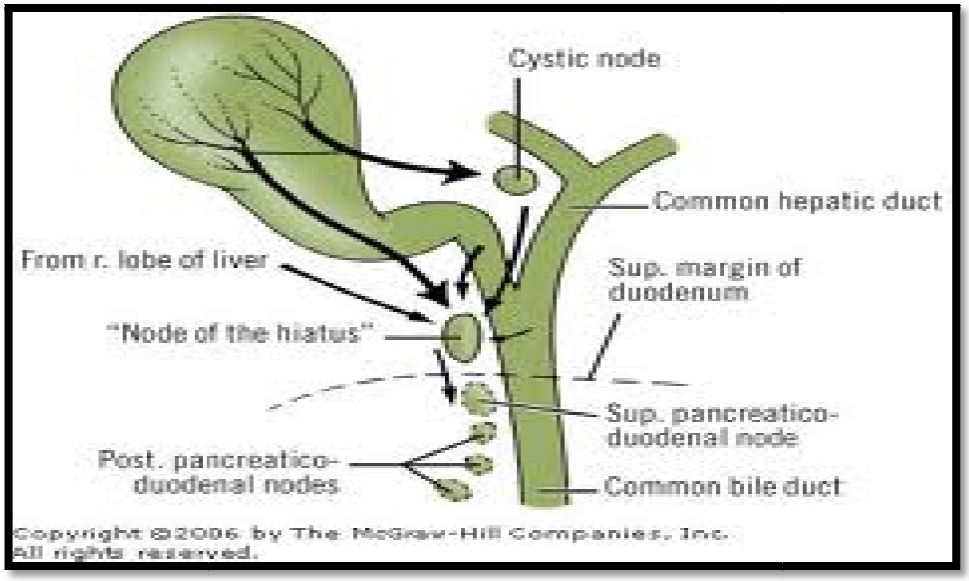
2. VENOUS DRAINAGE -

Veins from the fundus & body directly drain into hepatic sinusoids through visceral surface of liver. Cystic veins from the neck & cystic duct may drain directly into the liver or indirectly via portal vein into the liver.

3. LYMPHATIC DRAINAGE -

Lymph vessels drain into the cystic or hepatic nodes, which finally drain into celiac lymph nodes.

Figure 4: Lymphatic drainage



NERVE SUPPLY -

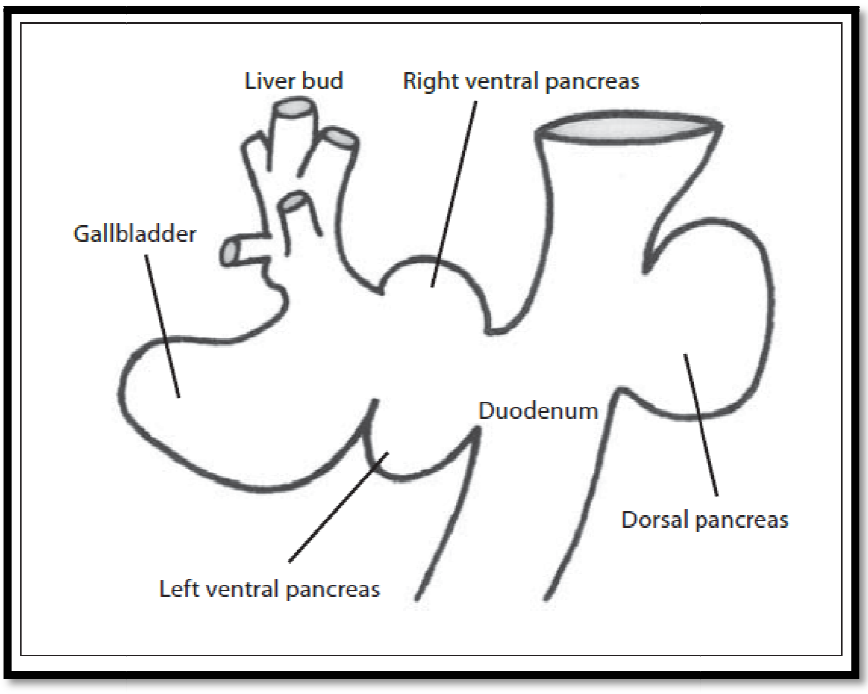
Sympathetic supply is from the nerves arising from the celiac nerve plexus. Parasympathetic supply is from the vagus and right

phrenic nerve, which reach the gallbladder along cystic artery. Parasympathetic stimulation causes contraction of gallbladder & relaxation of sphincter. Cholecystokinin secreted by the duodenal wall stimulates the contraction of the gallbladder.

EMBRYOLOGY [6]**-**

In 4th week of intra uterine life, hepatic diverticulum will appear in ventral part of midgut. This later develops into gall bladder, extra hepatic biliary ducts, liver and ventral part of pancreas. By 4th week, 2 buds will be formed with in the diverticulum. They are cranial and caudal buds. Liver and extra biliary tree are formed from cranial buds. Caudal bud in turn divides into superior bud and inferior bud. Cystic duct and gall bladder develops from superior bud. Right and left part of ventral pancreas develops from inferior bud. All parts of biliary tree will be recognizable by 5th week of intra uterine life.

Figure 5: Hepatic diverticulum at 4th week of intrauterine life



At the end of 5th week, recanalization of common duct occurs. Ventral pancreatic bud and common duct rotates by 180° around the duodenum by 6th week of intra uterine life. Pancreatic and bile ducts ends in duodenum by 7th week of intra uterine life. Between 8-12 th week, these ducts have two orifices namely superior and inferior. By 10th week of life, muscle of the sphincter will undergo differentiation[1,6].

Figure 6: Pancreatic and bile ducts ends in duodenum by 7th week of intra uterine life

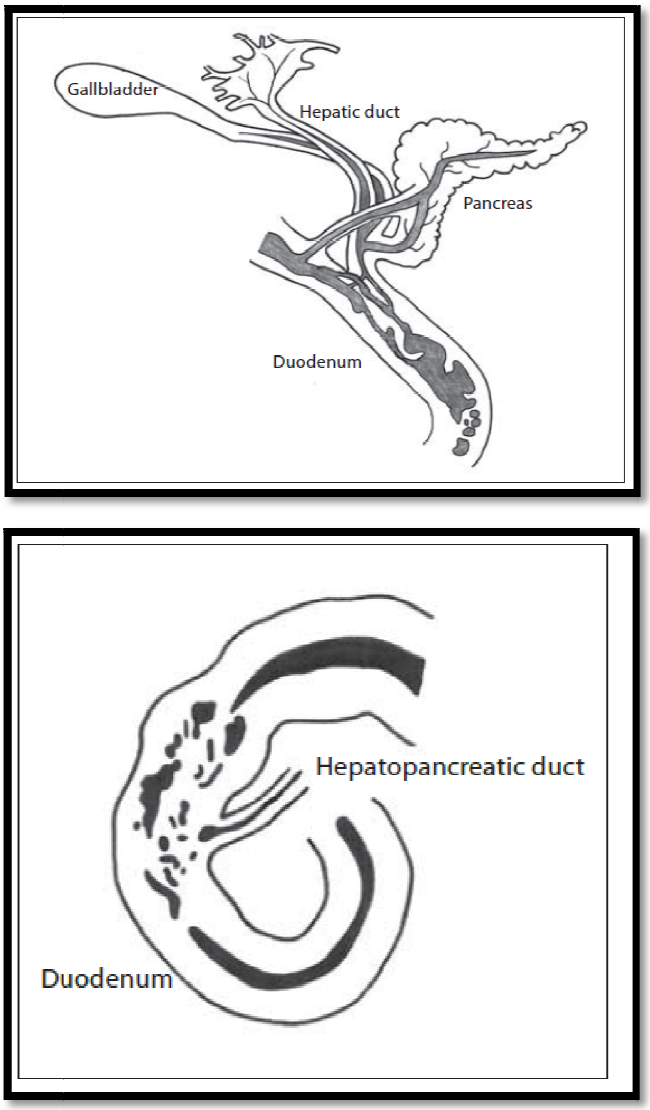
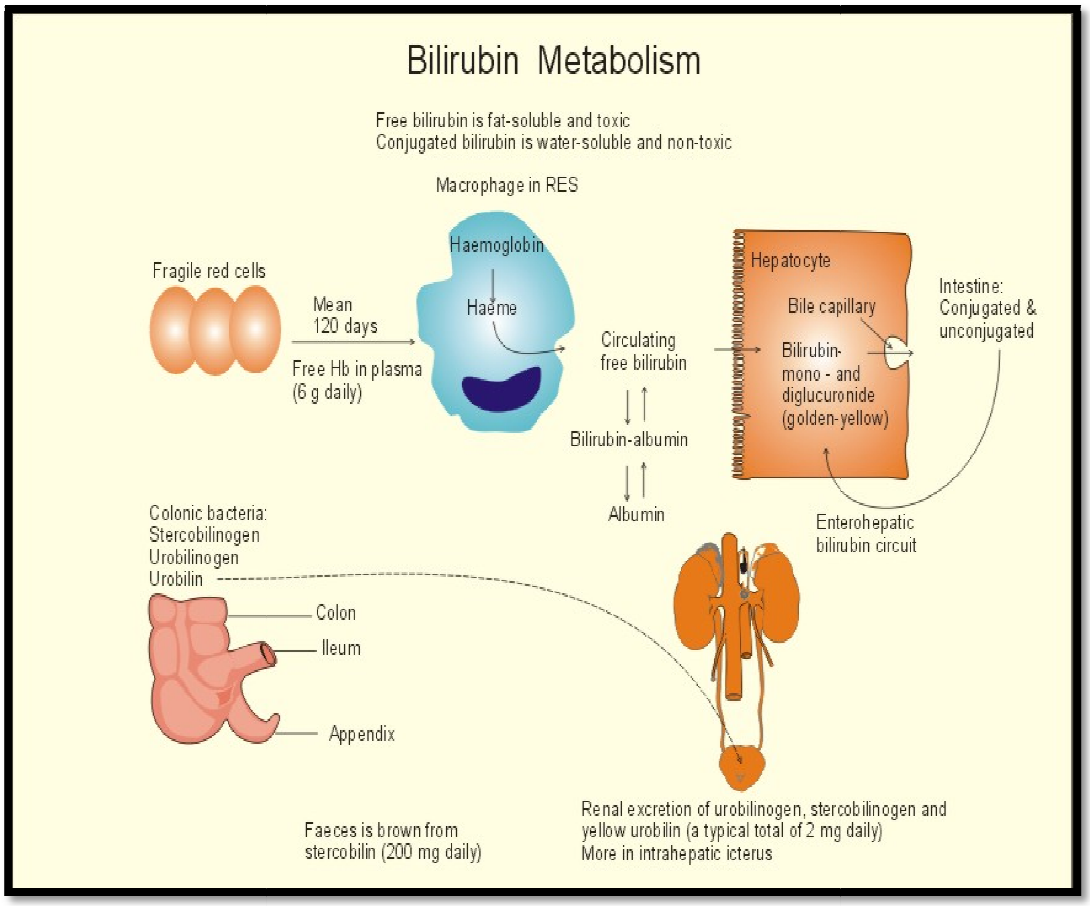
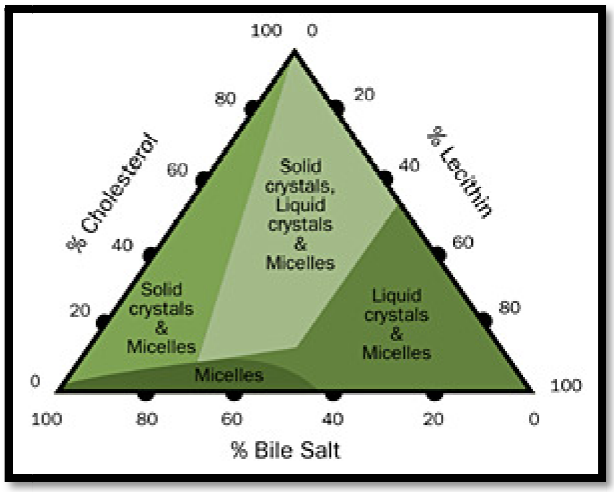


Figure 7 : Formation of bile



Bile is continuously produced from liver. This bile is excreted into biliary canaliculi. Liver usually produces 500-1000 ml of bile daily. Bile secretion depends on various stimuli like chemical, neurogenic and humoral. Bile production also depends on vagal stimulation. Through hepatic duct, bile passes into duodenum. Bile is composed of water, bile salts, electrolytes, lipids, proteins. pH of the bile is usually alkaline[1].

Figure 8: Composition of bile



CYSTIC DUCT -

The duct connecting the neck of gall bladder to common hepatic duct is the cystic duct. It measures 3-4cm in length, with a lumen diameter of 1 to 3mm. The mucosal layer of the cystic duct is thrown into spiral folds (spiral valve) which keeps it open when bile enters in and outside of the gallbladder[1,6,10].

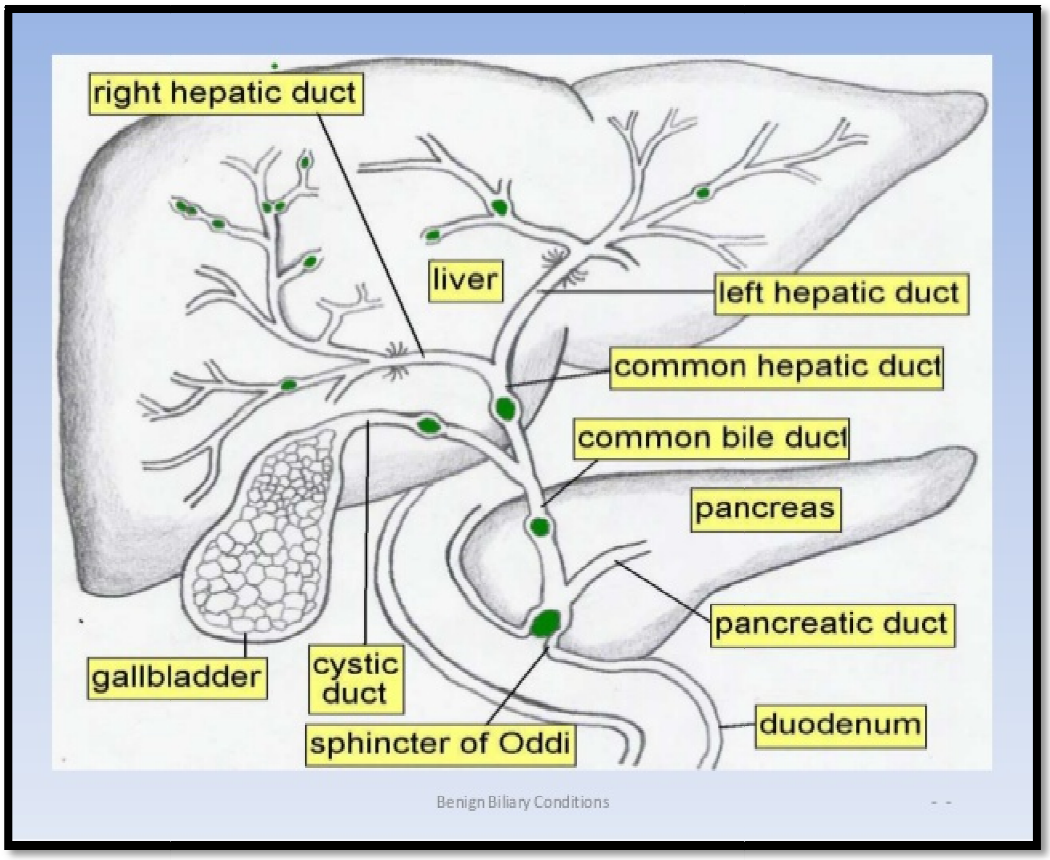
Cystic duct is opened with the aid of spiral valve, which regulates the bile entry inside the gallbladder when the hepato pancreatic sphincter closes distally and outside when the gallbladder contracts. At times of sudden increment of intra abdominal pressure the spiral valve prevents the sudden release of bile.

ANATOMY OF BILE DUCTS [1]

Bile ducts carry the bile produced in the liver to the duodenum. Whenever fatty food enters the duodenum, the stored and concentrated bile from the gallbladder is released into the duodenum (due to release of cholecystokinin from the duodenum). The fatty food in the duodenum is thus emulsified by the concentrated bile in the duodenum.

Biliary ducts are of two types (Figure 9) -

1. Intrahepatic biliary ducts
2. Extrahepatic biliary ducts



INTRAHEPATIC BILIARY DUCTS

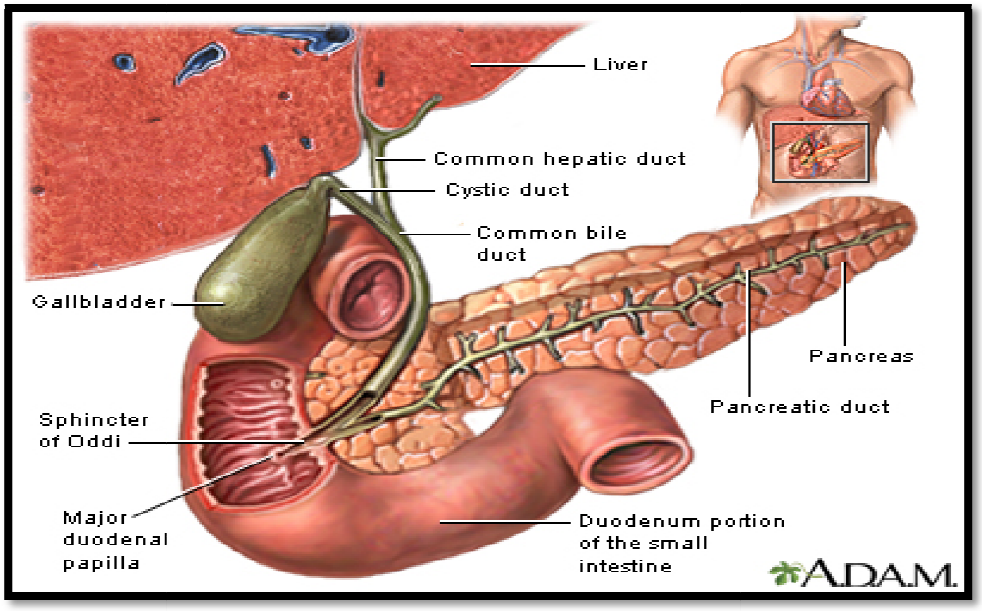
Bile is secreted by hepatocytes into the smaller bile canaliculi, which drain bile into the larger bile canaliculi. Segmental ducts are formed from larger bile canaliculi. Near the porta hepatis segmental ducts unite and form right and left hepatic ducts,which drain right and left parts of the liver respectively.

EXTRAHEPATIC BILIARY DUCTS

The right and left hepatic ducts join to form the common hepatic duct. Common hepatic duct measures about 1 to 4 cm in length. On the right side of the common hepatic duct, cystic duct joins acutely to form the common bile duct or choledochus.

Common bile duct measures 5 to 10 cm in length and 5 to 10 mm in diameter. Common bile duct opens into the second part of the duodenum which is guarded by sphincter of Oddi.

Figure 10: Extra hepatic biliary duct system



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Common bile duct has 3 parts. They are supraduodenal, retroduodenal and pancreatic parts.

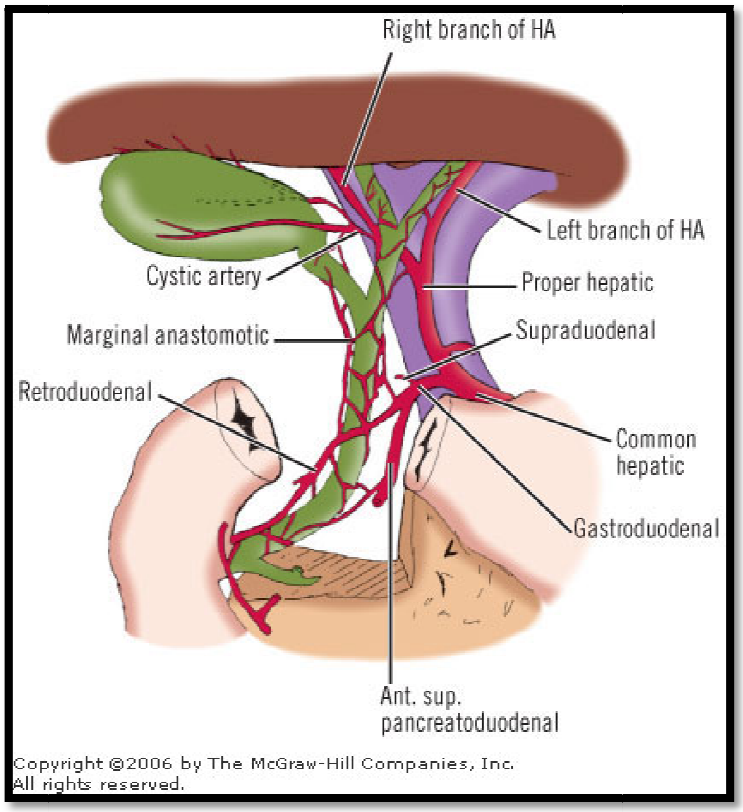
Posterior to upper part of duodenum, the bile duct descends & lies on the posterior surface of the pancreas. The bile duct joins the main pancreatic duct on left side of descending part of duodenum and forms hepatopancreatic ampulla in major duodenal papilla.

Sphincter of bile duct is the thickened circular muscle near the distal end of bile duct, which when contracts cannot allow bile to enter into the ampulla & duodenum, hence it passes in a retrograde manner to the gallbladder through cystic duct for concentration.

BLOOD SUPPLY [2]

ARTERIAL SUPPLY (Figure 11) -

Proximal part of bile duct is supplied by the cystic artery. Middle part is supplied by the right hepatic artery. Retroduodenal part is supplied by the posterior superior pancreatico duodenal artery.



VENOUS DRAINAGE -

Veins from the hepatic ducts and proximal part of bile duct enter liver directly. Veins from the distal part of bile duct drain into the posterior superior pancreatico duodenal vein, which empties into the portal vein.

LYMPHATIC DRAINAGE -

Lymphatics of biliary ducts drain into the cystic lymphnodes (near the neck of gallbladder), hepatic lymphnodes and celiac lymphnodes.

ANOMALIES OF GALL BLADDER[1] **(Figure 12 & 13)–**

The anomalies of gall bladder are mostly due to the result of abnormal development or arrest at any stage of embryonic growth. These anomalies are of three types basing on position, number and formation of gall bladder.

FIGURE 12

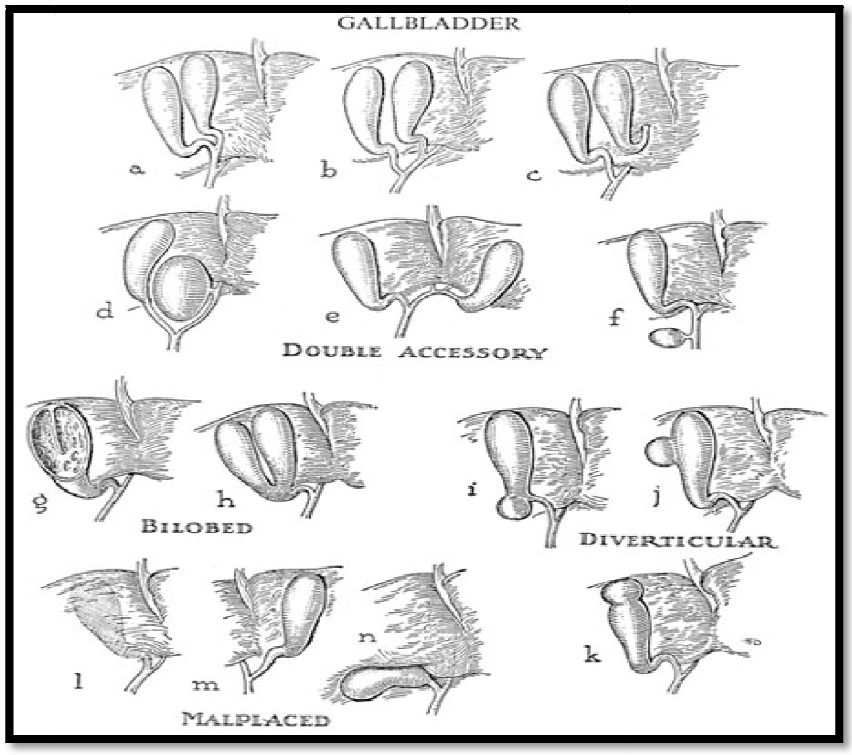
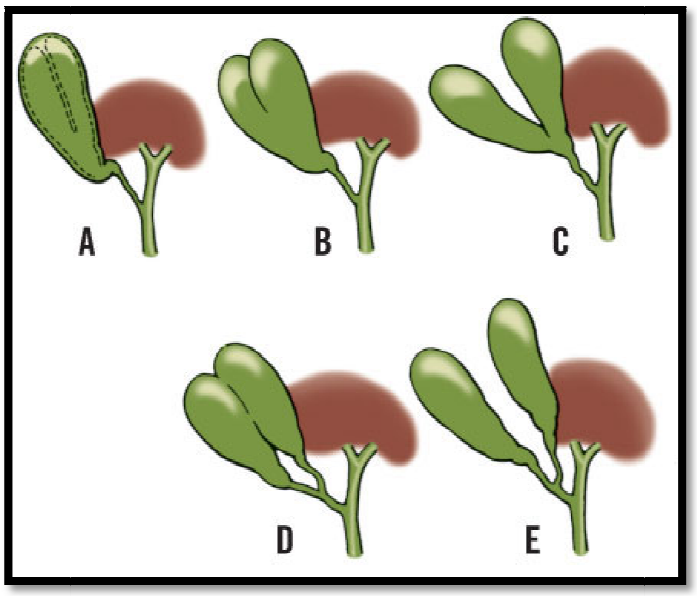


Figure 13



Based on position -

a. Left sided gall bladder

b. Intra hepatic gall bladder

c. Floating gall bladder

Based on formation –

Bi lobed gall bladder

Divarication of gall bladder

Rudimentary gall bladder

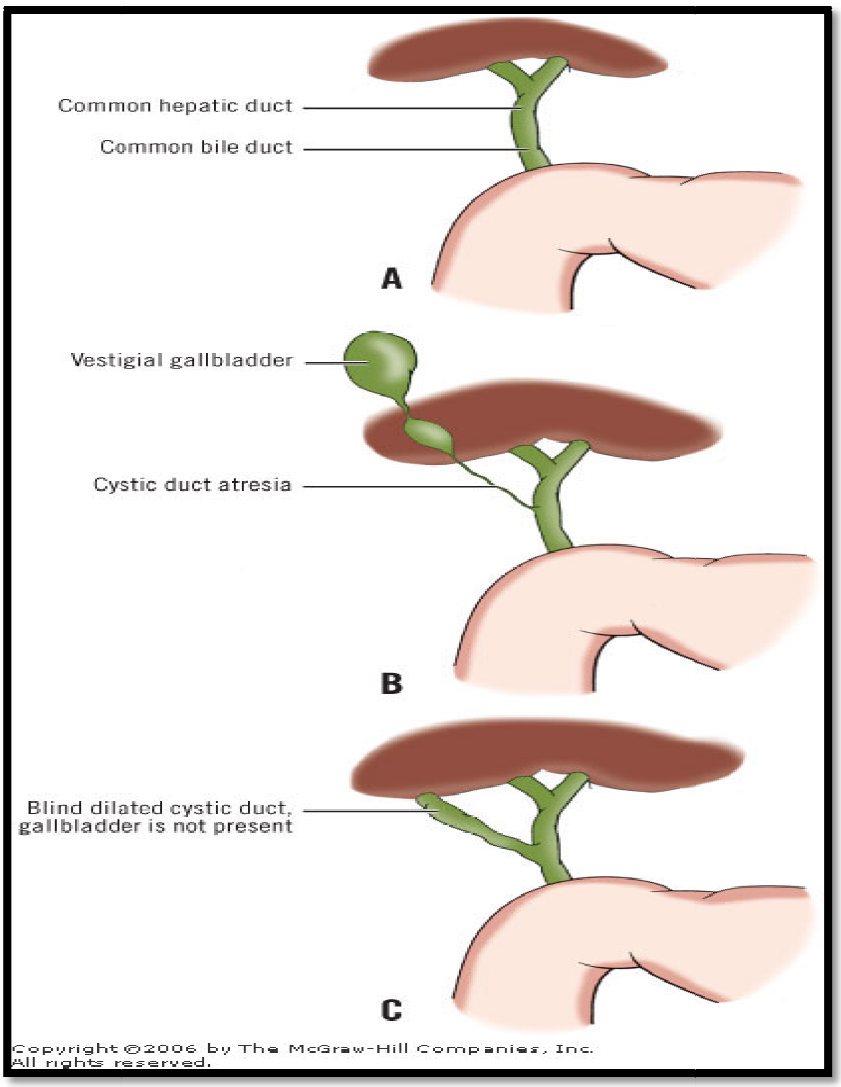
Hourglass gall bladder

Based on number:

1) Agenesis (absence) of gall bladder

2) Duplication of gall bladder

Figure 14: Agenesis of gall bladder

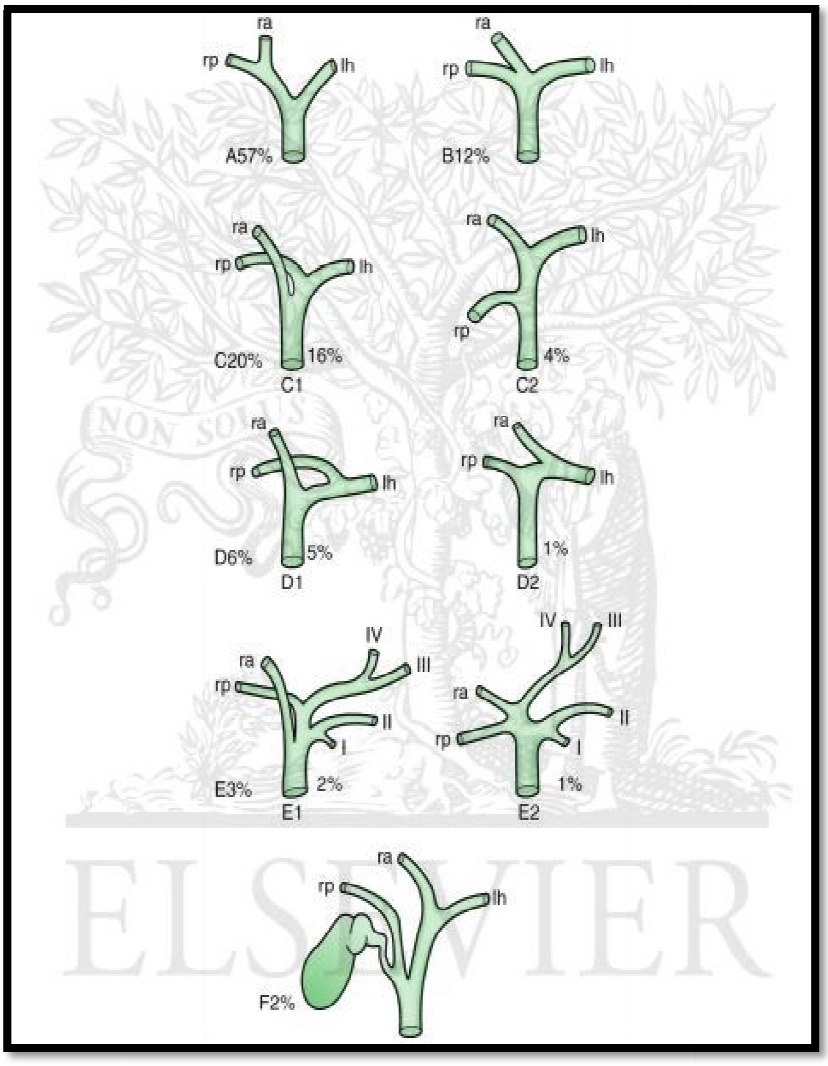


ANOMALIES OF BILIARY TRACT:

There is a great degree of variation in the extrahepatic biliary tree's anatomy, whose knowledge is of paramount importance to prevent injury of ducts during surgery.

These anatomical variations may involve either hepatic duct,cystic duct or common bile duct.

1) VARIATIONS IN HEPATIC DUCT: (Figure 15)



In 55 to 70 % of patients right hepatic duct is formed by union of right anterior & right posterior intrahepatic ducts. This right hepatic duct joins the left hepatic duct and forms the common hepatic duct.

Other variants are in 10 to 15 % common hepatic duct is formed by fusion of the right anterior hepatic duct, right posterior hepatic duct and left hepatic ducts at the same level.

In 10 to 20 % common hepatic duct is formed by the fusion of the right posterior hepatic duct and left hepatic duct at a point and then right anterior hepatic duct joins below the union.

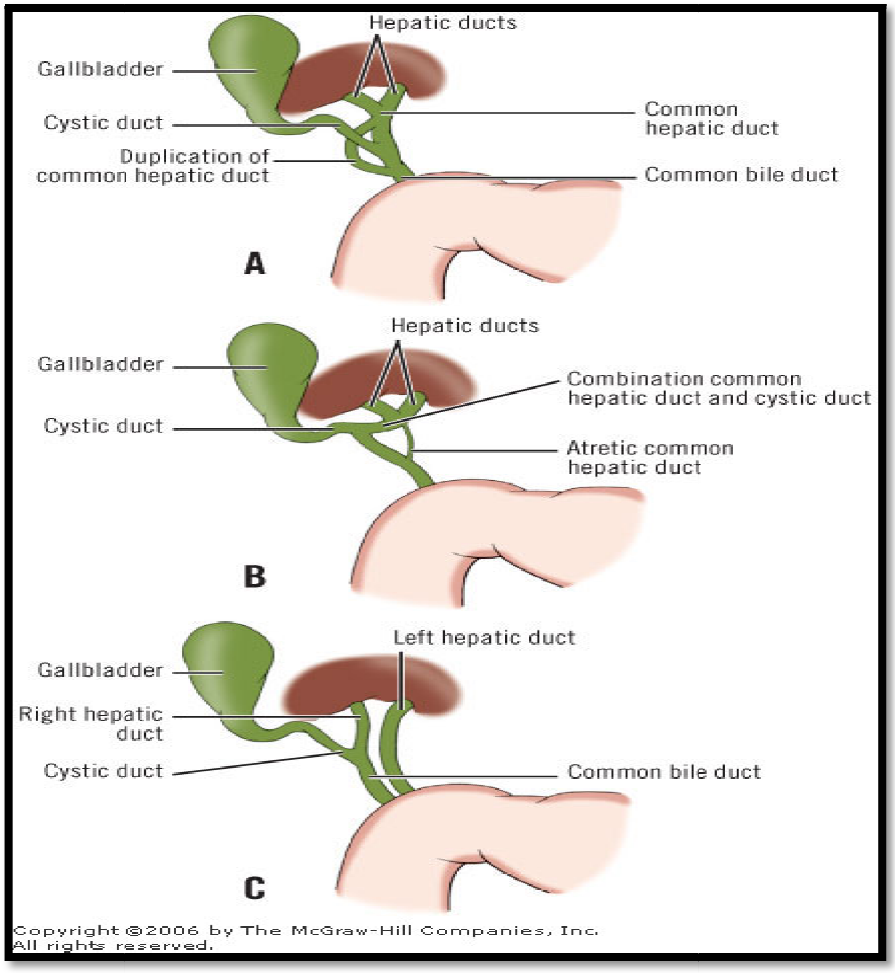
ACCESSORY HEPATIC DUCTS:

These ducts arise from the liver and fuse with either common hepatic duct or cystic duct or common bile duct. During dissection of calots triangle these accessory ducts may be injured as they course through the calots triangle.

CHOLECYSTOHEPATIC DUCTS:

These are the ducts that arise from the liver and enter hepatic surface of gall bladder,which if found should be ligated during dissection of gall bladder to prevent postoperative bile leak.

Figure 16: Variations in biliary system



2) COMMON BILE DUCT*:*

a) Duplication of the common bile duct may be observed.

b) Malposition of the common bile duct may be found.

These should be recognized to prevent fatal injury during surgery.

Some of the malpositions of the common bile duct are -

1) Two separate ducts entering the duodenum.

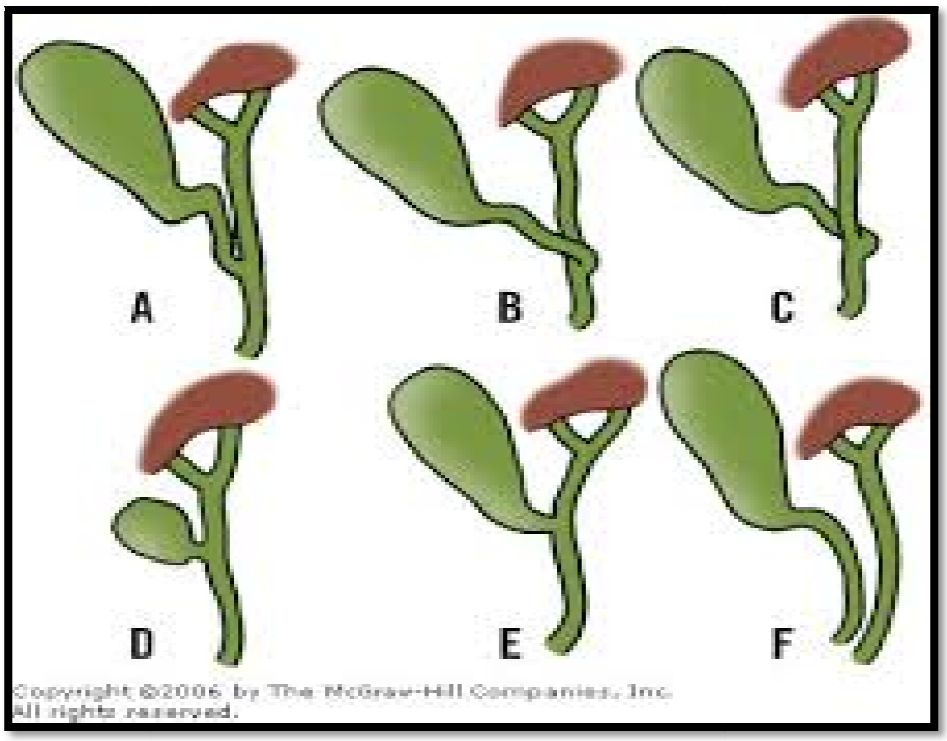
2) Bifurcating duct with one branch ending in duodenum and other in stomach

3) bifurcating with both branches ending in duodenum.

4) A single duct opening in to the gastric fundus, pylorus or antrum

3) CYSTIC DUCT (Figure 17):

Page proposed 5 anomalies of cystic duct, which are of paramount importance to surgeon during cholecystectomy. These include variations in the length of cystic duct, course of cystic duct and opening of cystic duct into the common hepatic duct.



Trifurcation is formed by fusion of the right hepatic duct, left hepatic duct and cystic duct at the same level. Cystic duct may be absent sometimes,when gallbladder directly opens into the common hepatic duct.

VASCULAR ANOMALIES:

In 10 to 15 % an accessory cystic artery may be present.

CATTERPILLAR HUMP OF RIGHT HEPATIC ARTERY:

Some-times right hepatic artery before passing upward to the hilum of the liver passes through the hepatocystic triangle in close relation to the cystic duct and may anamolies of Cystic artery some- times may run ventral to the common bile duct or common hepatic duct. During dissection in such cases it is seen first, which should be carefully ligated & divided very early during dissection for exposing the cystic duct adequately.

DISEASES OF GALLBLADDER[1,2,6]

Digestive tract is affected by gall stone disease by around 11 to 36 %.The following conditions have more chances of developing gallstones :-

- Gastric surgeries
- Sickle cell disease

- Hereditary spherocytosis
- Thalassemia
- Dietary factors
- Pregnancy
- Obesity
- Crohn's disease
- Terminal ileal resection

Females are more likely to develop gallstones than males by three times.

HISTORY –

Gallstones for most of the time remain asymptomatic & some suddenly become symptomatic for reasons unknown. Patient's develop biliary colic due to obstruction of cystic duct by a stone. Some complications are noted in symptomatic gallstone disease. They are : -

- Cholecystitis
- Gallstone pancreatitis
- Choledocholithiasis without / with cholangitis
- Cholecystocholedochal fistula
- Cholecystoenteric fistula
- Cholecystoduodenal fistula

- Carcinoma gallbladder

Incidental diagnosis of gallstones in patients without biliary symptoms is by ultrasonography done during Master Health Checkup, CT scans or during laparotomies. About two thirds of the asymptomatic gallstone patients remain without symptoms for over 20 years. Prophylactic cholecystectomy is done only in people who have increased risk of developing gallbladder carcinoma, in elderly & obese patients with diabetes and in people who live far away from medical facilities for longer periods of time.

Pre-malignant conditions like porcelain gallbladder (calcified gallbladder wall) is an absolute indication for cholecystectomy.

TYPE OF GALLSTONES [1,11]

Major constituents of gallstones are bilesalts, cholesterol, bilirubin and phospholipids.

- Pigment stones – 1. Brown

  2. Black (15 – 20 %)

- Cholesterol stones (80 %)

PIGMENT STONES –

BROWN STONES (Figure 18): -

They are formed due to bacterial infection caused due to stasis of bile, present mostly in the bile ducts or gallbladder in people of Asia. But brown stones are seen as primary bile duct stones in people with bile duct stones which cause stasis and contamination due to bacteria and in patients with biliary strictures in Western populations.

Major portions of brown stones contains precipitated calcium bilirubinate and cell bodies of bacteria. Bacteria like Escherichia coli secrete beta – glucuronidase which cleaves bilirubin glucuronide to produce insoluble unconjugated bilirubin enzymatically. Which further

precipitates with calcium and dead bacterial cell bodies and forms brown stones in biliary tree.

They are brownish to yellow in colour, soft and less than 1cm in diameter.

BLACK STONES (Figure 19): -

They are seen often secondary to hemolytic disorders such as sickle cell disease, hereditary spherocytosis and in liver cirrhosis. They form in gallbladder. Production of unconjugated bilirubin increases in case of liver cirrhosis .Conjugated bilirubin is more soluble than unconjugated bile in bile. Bilirubin deconjugation occurs at a slow rate

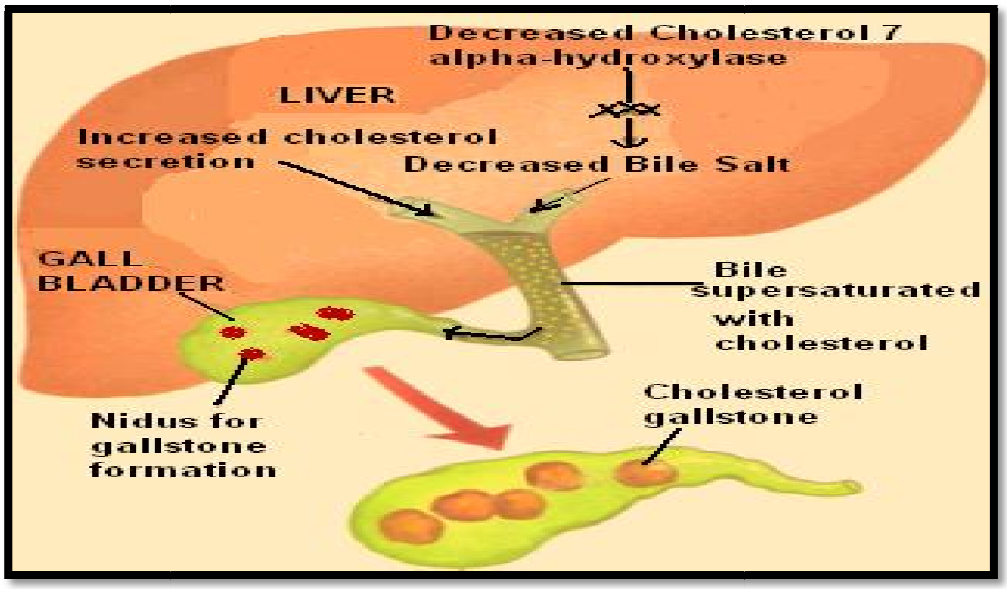
in bile. In hemolytic states there will be excess levels of conjugated bilirubin leading to increased unconjugated bilirubin production rate.

When the above explained altered conditions lead to excess level of deconjugated bilirubin in bile , precipitation with calcium occurs. Black pigment stones are formed due to supersaturation of carbonate, phosphate and calcium bilirubinate mostly secondary to hemolytic disorders. They look speculated, black, small and brittle.

CHOLESTEROL STONES

Cholesterol is secreted as cholesterol – phospholipid vesicles into bile. Supersaturation of bile with cholesterol is seen in formation of cholesterol stones. Cholesterol is insoluble in bile and water and nonpolar. Supersaturation does not depend on reduced secretion of bile salts or phospholipids but is caused by hypersecretion of cholesterol. The relative concentration of bile salts , cholesterol and lecithin (main phospholipid in bile) plays a major role in solubility of cholesterol. Less than 10 % of these stones are radioopaque , the remaining 90 % are radiolucent. These stones are usually hard to soft , multiple and irregular in shape.

Figure 20 & 21: Cholesterol stone formation



IMAGING STUDIES TO DIAGNOSE BILIARY TREE DISEASE[2] –

- Transabdominal Ultrasound
- Plain radiographs
- Hepatic Iminodiacetic Acid Scan [HIDA]
- Computed Tomography
- Magnetic Resonance Imaging
- Magnetic Resonance Cholangiopancreatography [MRCP]
- Endoscopic Retrograde Cholangiopancreatography [ERCP]
- Percutaneous Transhepatic Cholangiography [PTC]
- Intraoperative Cholangiography
- Endoscopic Ultrasound [EUS]
- Fluorodeoxyglucose Positron Emission Tomography[FDG-PET]

LABORATORY TESTS –

- Liver function tests

SYMPTOMATIC GALLSTONES –

ACUTE CHOLECYSTITIS: -

In 90 to 95 % of case it is secondary to gallstones, 1 % is due to tumor obstructing the cystic duct. Gallbladder distention, inflammation and edema of gallbladder wall is due to obstruction of cystic duct by a

gallstone. Presence of pericholecystic fluid is seen in some cases. In patient's having acute uncomplicated cholecystitis, should undergo cholecystectomy if they show features of secondary bacterial contamination.

In some cases of acute cholecystitis, inflammatory changes may progress to ischemia followed by gallbladder wall necrosis. In such cases inflammation subsides on spontaneous dislodgement of the gallstone. But if the gallstone persists it leads to obstruction followed by secondary bacterial infection leading to acute gangrenous cholecystitis (empyema / abscess formation in the gallbladder occurs) and areas of ischemia may undergo perforation in rare cases.

Emphysematous gallbladder is due to secondary bacterial infection caused by gas forming organisms and can be diagnosed by taking CT scans or abdominal radiographs in which the gallbladder lumen and the wall is seen filled with gas.

CLINICAL FEATURES –

- Biliary colic [pain is observed typically in the right hypochondrium or epigastric regions radiating to the space between both the scapula's or to the upper back on the right side]
- Fever

- Vomiting
- Nausea
- Anorexia
- Positive Murphy's sign [on deep palpation in right subcostal area there will be an inspiratory arrest

LAB TESTS

- Leucocytosis , mild to moderate
- Mild elevation of - serum bilirubin

  alkaline phosphatase

  amylase

  transaminases

DIFFERENTIAL DIAGNOSIS –

- Pancreatitis
- Appendicitis
- Pleuritis
- Pneumonia
- Peptic ulcer without or with perforation
- Hepatitis
- Herpes zoster affecting the intercostal nerve

TREATMENT –

- I.V. fluids , antibiotics and analgesia
- Cholecystectomy
- Percutaneous cholecystostomy followed by cholecystectomy

CHRONIC CHOLECYSTITIS [1,6,12]

Characterized by recurrent abdominal pain as seen in acute cholecystitis. The pain becomes severe during night or after taking a fatty meal. After undergoing Cholecystectomy in patients with typical biliary symptoms and stones ,are relieved from their complaints .But in patient's with symptoms like belching ,abdominal distention , abdominal discomfort on consuming diet containing fat the results after performing cholecystectomy are not satisfactory.

CHOLEDOCHOLITHIASIS [12]

Stones in the common bile duct are found in 6 to 12 % of patient's suffering from gallbladder stones. They vary from large to small in size and may be single or multiple and incidence increases with age. There are two types of common bile duct stones.

1. **Primary stones -**

Formed in the bileduct. They are mostly associated with infection due to biliary stasis generally seen in conditions of papillary stenosis, tumors, biliary strictures.

2. **Secondary stones –**

Formed in the gallbladder but gets migrated to the common bile duct via the cystic duct. Most of the secondary stones are made of cholesterol.

MANAGEMENT –

Preoperative endoscopic cholangiography or intraoperative cholangiogram before proceeding to sphincterotomy and clearing the stones from the bile duct and followed by cholecystectomy.

In cases where the stones are lodged in the ampulla, choledochoduodenostomy or a roux-en-Y choledochojejunostomy is performed as endoscopic ductal clearance or open / laparoscopic common bile duct exploration will be difficult.

Retained stones are removed either endoscopically or T tube tract under fluoroscopic guidance using balloons or baskets.

CHOLANGITIS [1]

Bacterial contamination and obstruction of bile flow in bile ducts leads to cholangitis, gallstones being the most common cause for obstruction. Other causes include stents insitu, malignant or benign strictures,parasites and obstructed biliary – enteric anastomosis.

Common organisms causing cholangitis are Escherichia coli, Streptococcus faecalis, Klebsiella pneumonia, Bacteroides fragilis and Enterobacter.

CLINICAL FEATURES

- Life threatening septicemia
- Charcot's Triad – fever, jaundice and pain in the right hypochondrium
- Reynolds pentad – fever, jaundice,pain in the right hypochondrium, changes in mental status and septic shock

MANAGEMENT

- Fluid resuscitation
- Intravenous antibiotics
- May require intensive care monitoring
- Decompression of the biliary system

- Endoscopic decompression by placing biliary stent, sphincterotomy or by stone removal is done in cases of periampullary malignancies and in patient's with choledocholithiasis.
- Percutaneous transhepatic drainage is done in cases where there is stricture in biliary – enteric anastomosis or in cases where the obstruction is more perihilar or proximal.
- Common bile duct decompression using a T tube is done if the above said procedures fail.
- Operative procedure is executed one when the features of cholangitis settles
- Periodical replacement of the stent using a guidewire and imaging should be done in patients suffering from cholangitis and who have stents insitu.

COMPLICATIONS –

If its associated with the following conditions mortality rates are higher in patient's suffering from cholangitis : -

- Cardiac ailments
- Malignant conditions
- Renal failure
- Hepatic abscess

CHOLANGIOHEPATITIS[1,6] –

Bacterial contamination is the main cause for cholangiohepatitis . E.coli , Bacteroides & Klebsiella species, Enterococcus faecalis being the main organisms. Certain parasites are also involved namely Ascaris lumbricoides, Clonorchis sinensis and Opisthorchis viverrini. Deconjugation of bilirubin which further precipitates as bile sludge is due to the bacterial enzymes.

Dead bacterial cell bodies and bile sludge together form brown stones. Repeated episodes of cholangitis is due to the partial obstruction of the biliary tree due to these stones.Biliary strictures which are formed due to recurrent cholangitis leads to infection, liver cell failure, infection , stone formation and hepatic abscess.

Pain in the epigastrium or right upper quadrant, jaundice and fever are the most common presenting complaints of patients suffering from cholangiohepatitis. Recurrence of the above said symptoms is commonly seen with varying degrees of severity and need immediate intervention before progressing to hepatic insufficiency and malnutrition.

Pneumobilia due to infection caused by organisms forming gas, biliary tree with stones, strictures and rarely liver abscesses can be detected by an ultrasound.

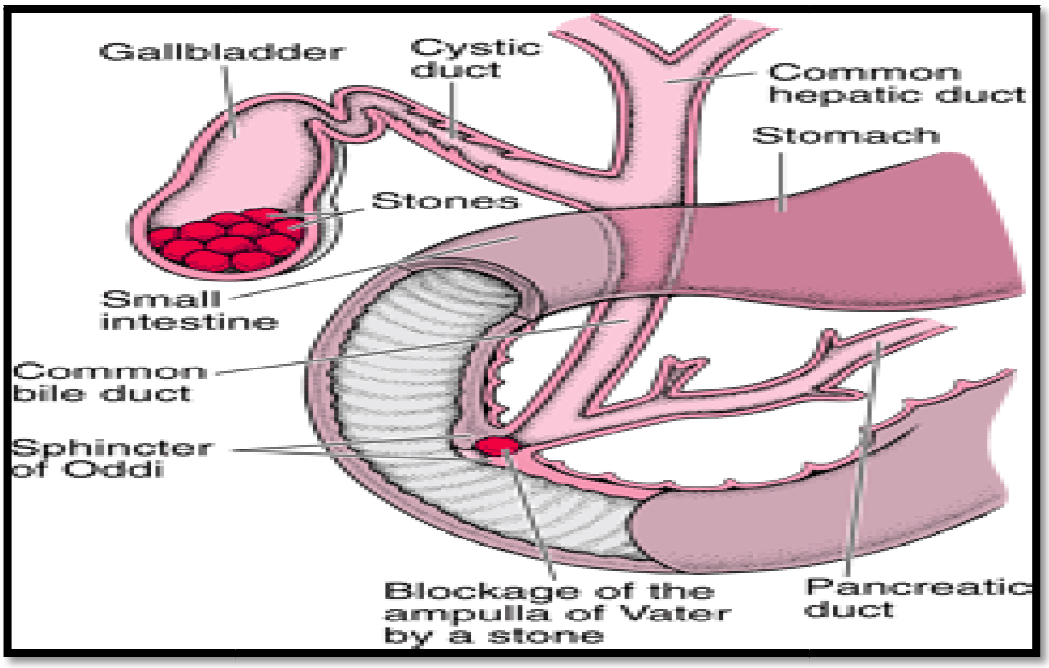
But the chief confirmatory biliary imaging studies in case of diagnosing cholangiohepatitis are PTC and MRCP. Along with it it can also help in diagnosing stones, strictures ,obstructions and permits immediate decompression of the biliary tree in septic patients. Absolute and long term treatment includes removal of the stones and debris and to relieve strictures. This may include Roux-en-Y hepaticojejunostomy to establish biliary-enteric continuity

Poor prognosis is seen in patient's who developed hepatic insufficiency and occasionally best form of treatment involves resection of the affected areas of the liver.

BILIARY PANCREATITIS[12]

Pancreatic duct obstruction due to a stone while passing through the ampulla or by an impacted stone leads to pancreatitis. If the pancreatitis is severe stone extraction by sphincterotomy or ERC is done for immediate relief for the patient. Cholecystectomy is done after the episode of pancreatitis subsides.

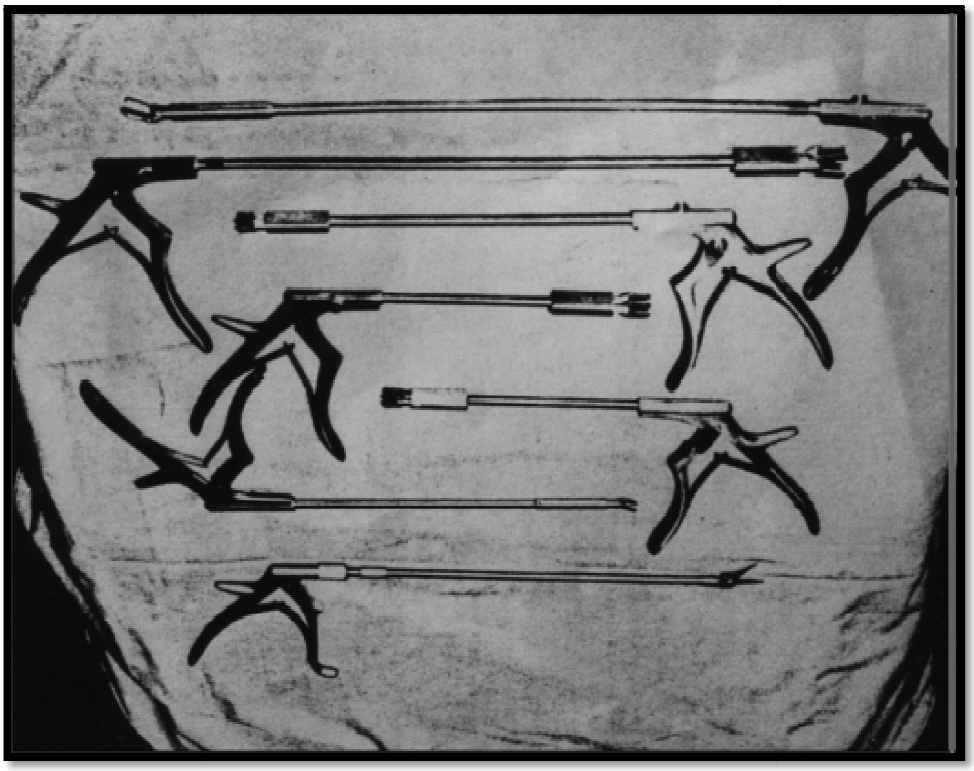
Figure 22: Obstruction at Ampulla of Vater



HISTORY[1,3,11]

Earliest recorded endoscopic references dates back to ancient times with Hippocrates. He suggested to inject large quantity of air through the anus in cases of intestinal obstruction. He used minimally invasive procedures to treat complications which are life threatening.

Figure 23 & 24: Laparoscopic instruments used in 1980s



First open cholecystectomy for gallstone disease was done in 1882 by Carl Langenbuch. Eric Muhe in Boblingen, Germany was credited for performing first laparoscopic removal of gall bladder in 1985 and two years later Philippe Mouret did laparoscopic cholecystectomy in Lyon, France. In recent years laparoscopic surgery has undergone remarkable development.

By 1990, 10 % of gallbladder removals in United States were done laparoscopically. By 2006 it increased drastically to 88% , which standout in the history of surgical revolution for the quick change. First robotic assisted cholecystectomy was performed in 1997.

INDICATIONS [2]–

1. Cholelithiasis
2. Empyema GB
3. Mucocele GB
4. Biliary pancreatitis
5. Cholangitis
6. Asymptomatic gallstones

CONTRAINDICATIONS –

1. Portal hypertension
2. Peritonitis
3. History of upper quadrant surgeries in the past
4. Coagulopathies
5. Advanced acute cholecystitis
6. Cholecystoenteric fistula
7. Carcinoma GB
8. Pregnancy (excluding second trimester)

PATIENT PREPARATION [2]–

With respect to the patients head, monitors were placed at 2 o' clock and 10 o' clock position. On left and right side of the patient, surgeon and 1st assistant will stand respectively.

ANAESTHESIA[2] :

Due to the risk of bowel distension, nitrous oxide is avoided. Intravenous fluids should be administered cautiously during LC than open cholecystectomy because fluid loss through the closed abdomen is minimal. Decreased urine output during LC is common due to the pneumoperitoneum created as it increases the release of anti diuretic hormone. Venous thromboembolic prophylaxis is a must. For easier abdominal access establishment and minimal chances of injury, decompression of bladder and stomach is necessary.

EQUIPMENT USED[2,11] :

1) High quality video laparoscope with 300-W light source
2) 2 high resolution monitor
3) High flow CO2 insufflator
4) 4 trocars (two 10mm and two 5mm trocars)
5) Monopolar electrode L-hook with irrigation and suction capacity
6) Two gall bladder graspers
7) A fine tip dissector
8) A pair of scissors
9) Large gall bladder extractor
10) Medium to large haemoclip applier
11) 10 mm stone retrieval grasper

Figure 25: Maryland dissector

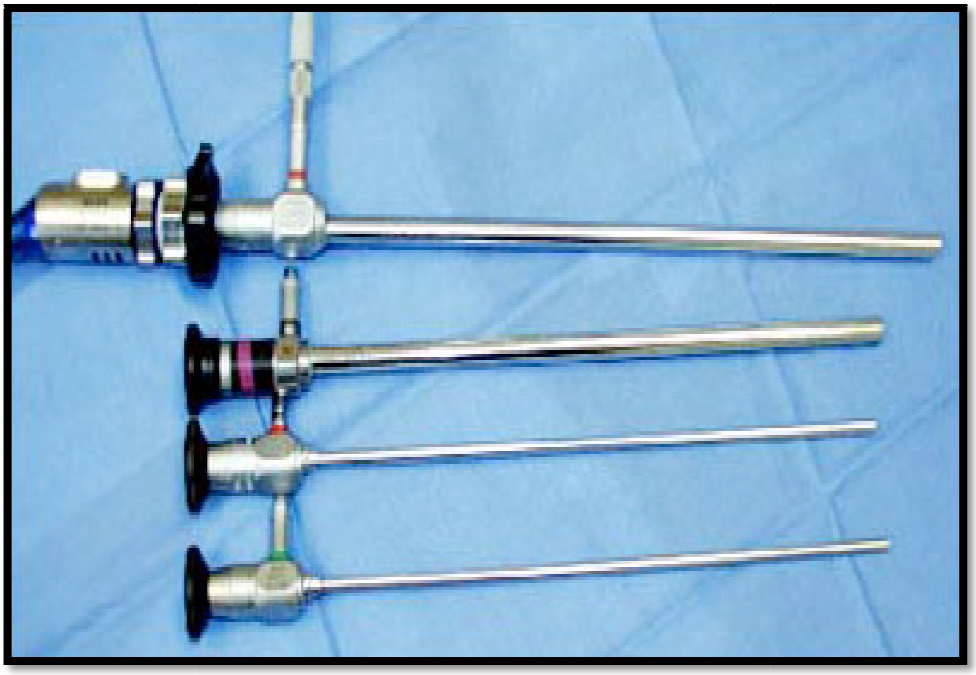
Figure 26: Scissors and atraumatic grasper

TELESCOPE [2]**–**

Diameter of the most commonly used telescope is 10 mm followed by 5 mm. Telescopes with 1.1 mm diameter are usually used in children.

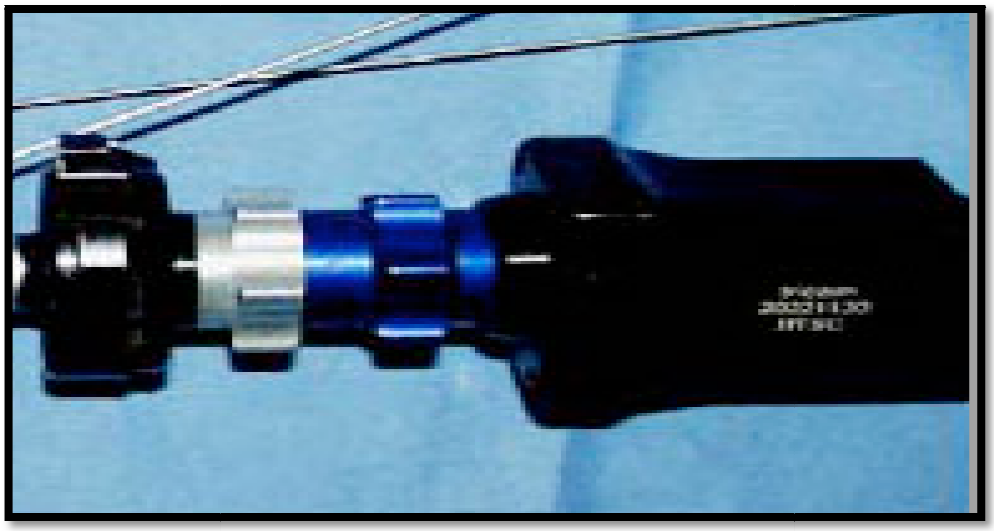
- 0 degree telescope - provides straight on view with only 76 degrees
- 25 to 30 degree telescope – total field of view is 152 degrees
- 40 to 50 degree telescope – total field of view is 152 degrees

Figure 27 : Telescopes



VIDEO CAMERA[2] (Figure 28) **–**

For the purpose of processing eyepiece is attached to the camera. Video image is processed into digital or an analog form after getting transmitted through a cable to a video



LIGHT SOURCE –

Mercury, xenon or halogen vapours are used to provide high intensity light. Intensity of light required is based on the surgery planned. Fibre optic cable is used to carry the light to the fibre optic bundles of laparoscope.

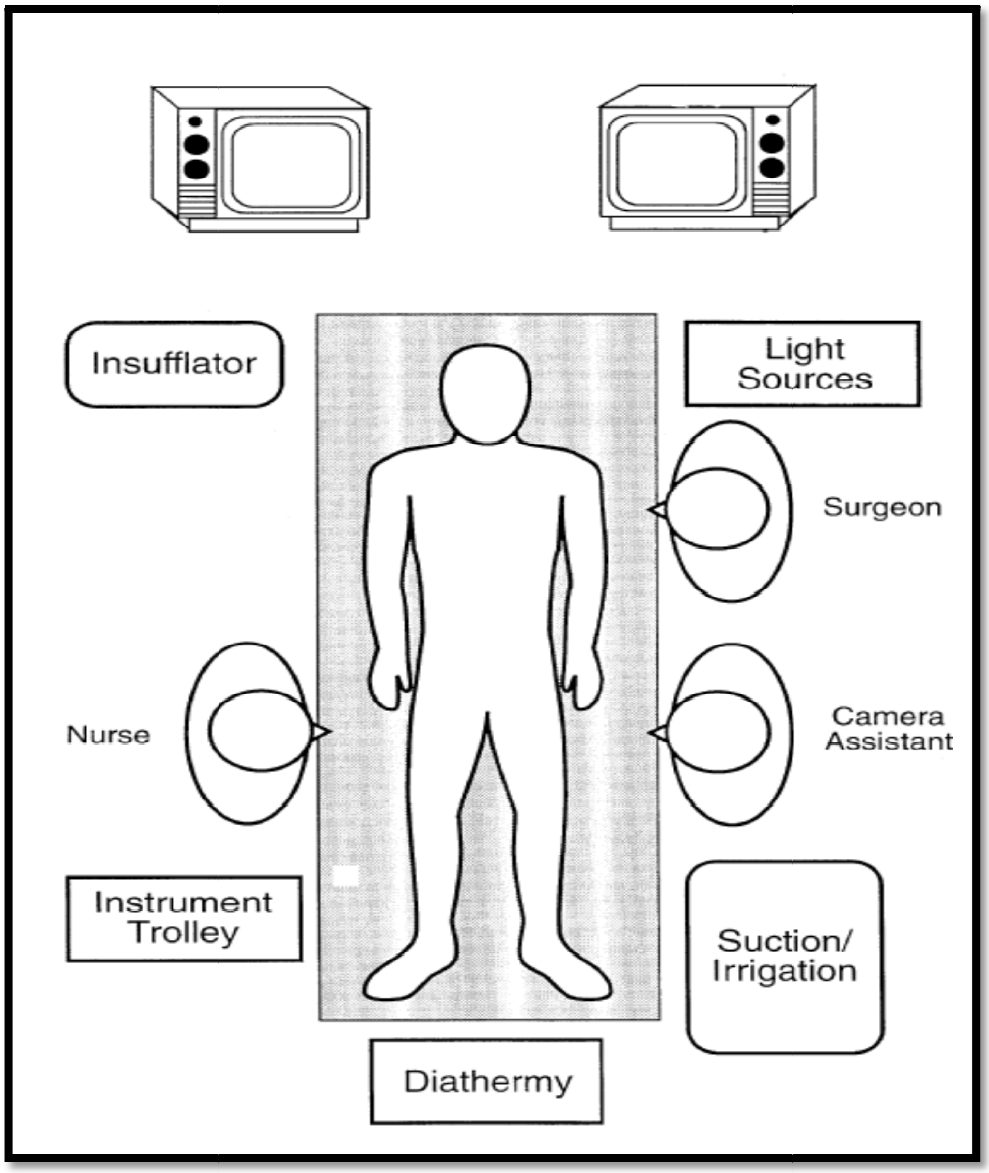
INSUFFLATORS –

They are used to transfer gas to the patient from a cylinder at a specified rate and controlled pressure. Usually pressure is maintained at 12 to 15 mm hg and can be reduced to a minimum pressure of 8 mm hg.

VIDEO MONITORS[2] **–**

Image is displayed using a high resolution monitor.Cathode ray monitors which are used regularly are being replaced by flat panel digital monitors which have spatial resolution.

Figure 29 : Operation theatre setup



Pneumoperitonium:

Generally used gases to create pneumoperitonium are CO2, Nitrogen oxide, Helium and Argon. CO2 flow rate is kept below 2lts /min initially to make sure proper placement has occurred before insufflating large volume of gas. The intra abdominal pressure can be increased to 15mm Hg by increasing the CO2 flow rate[2].There are several methods to create pneumoperitoneum.

1. One method is by passing a specialized needle through the umbilicus called a Veress needle .To check whether the placement is proper ,saline is taken in a plungerless syringe and passed through the needle and then attached to the CO2 insufflator tubing. Needle position intra abdominally can be checked by the tympanic note on percussion, variable intra abdominal pressure by decreasing and increasing the abdominal wall and to look for equal distention of the abdomen.
2. Other method is by entering the abdominal cavity under direct vision in a method called open Hasson cutdown technique .In this technique trocar is inserted after entering the peritoneal cavity and stay suturing done to fix it followed by insufflating the abdominal cavity with CO2.

3. Third method is the Optic View Port system in which we can visualize the trocar penetrating all the layers of the abdominal wall by using a specialized transparent laparoscope port.

Trocar placement[11]**:**

Two 10 mm trocars –

- Umbilical trocar
- Epigastric trocar (angling towards the gallbladder by starting from the midline)

Two 5 mm trocars –

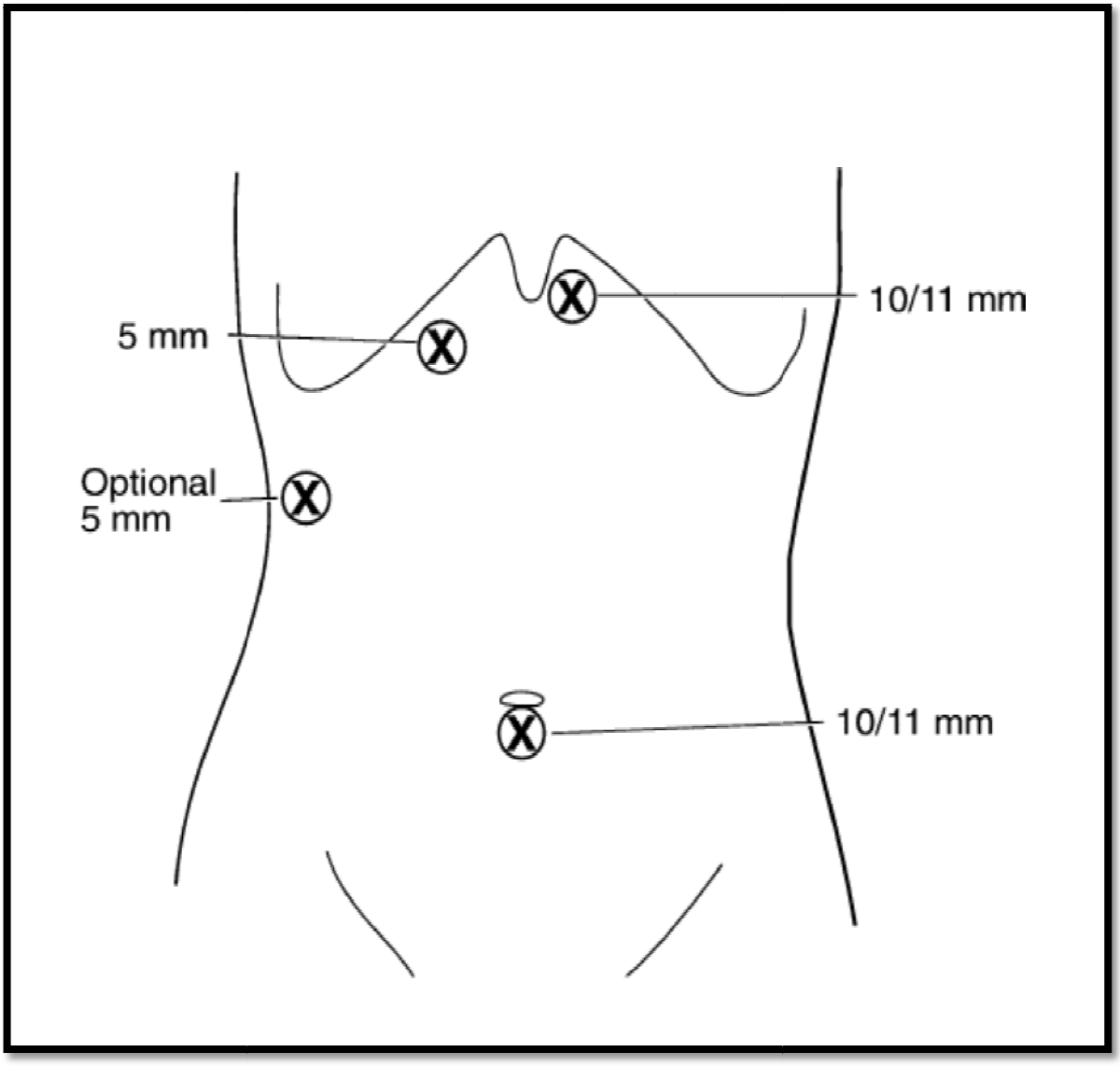
- Right upper quadrant
- In the midclavicular line 2-3 cm below the costal margin

First place the 10 mm umbilical trocar and laparoscope is inserted for general exploration of the abdomen. Usually 0 degree and 30 degree laparoscopes are used. 30 degree laparoscopes are more flexible and allows to get a complete view of the portal area and the structures around it and the risk of inadvertent injury is decreased.

Patient is placed in reverse Trendelenburg position with the operating table turned to left side down. Under laparoscopic guidance 5 mm trocars are placed,usually two finger breadths below the costal

margin. One placed in the anterior axillary and other in the midclavicular lines. Trocars should be 8-10 cm apart. Placement of the fourth trocar is important as it is used for the main operating instrument. Usual location is the epigastric region 10 cm away from the laparoscope directed to the right of the falciform ligament.

Figure 30 : Port placement sites



LAPAROSCOPIC CHOLECYSTECTOMY SURGICAL TECHNIQUE[1,2,11] **–**

It includes the following steps :

1. Exposure of the Porta Hepatis
2. Stripping the peritoneum
3. Gallbladder pedunculation
4. Control of Cystic artery and Cystic duct
5. Resection of the gallbladder
6. Removal of the gallbladder

Liver is elevated gently by passing two atraumatic graspers (which are inserted through the right subcostal trocars) beneath the visible part of the liver. Gall bladder is seen with or without omental adhesions. Liver and gall bladder are adherent to the underlying structures like omentum, stomach, duodenum and colon. Hence utmost care should be taken while releasing the adhesions using a cautery, from damaging the surrounding structures.

Gall bladder is punctured using a veress needle by lifting the liver followed by elevating the Gallbladder in cases where it is tense and shows inflammatory changes. Decompress the gall bladder by suctioning out the contents. Fundic grasper is placed at the punctured

site to hold it closed during retraction followed by suturing the punctured site . After exposing the gall bladder fundus it is grasped with a atraumatic locking grasper present at the medial most right subcostal .The gallbladder is pushed towards the right shoulder over the liver opening the subhepatic space to expose the infundibulum of the gallbladder .The infundibulum is retracted laterally to expose the Calot's triangle

Second atraumatic grasper is placed at the base of the gallbladder. Where as with the right hand epigastric port dissection around the gallbladder is done and left hand is used to retract the infundibulum in case of Two Handed technique. With the left hand the surgeon manoeuvre's the laparoscope port while the assistant can control both the graspers alternatively. Start dissecting around the gallbladder. Adhesions at the base of the gallbladder are released by sharp dissection.

Identify the cystic duct at its entry into the gall bladder. The infundibular grasper is moved side ways , back and forth in such a way that the junction between the gall bladder and cystic duct can be carefully separated. Cystic duct is dissected to a particular length so that it facilitates in performing cholangiography in some patients. Usually 1 c

m of cystic duct is necessary to place a clip safely. In total three clips are placed, two towards the cystic duct and one towards the gall bladder side. Enough place should be left to divide the cystic duct.

The gall bladder is held adjacent to the cystic duct by adjusting the infundibular grasper. Retract the gall bladder to the anterior and lateral sides and expose the cystic artery by dissecting using a Maryland dissector. After dissecting, the cystic artery is identified by its visible pulsations seen along the coarse of the gall bladder.

Clips are applied and cystic artery is divided leaving atleast two clips towards the stump of cystic artery. After dividing the cystic artery , it facilitates to mobilize the gall bladder with the help of an infundibular grasper away from the porta hepatis. Gall bladder is lifted to an extent so that it can be pushed above the edge of the liver with the help of a grasper.

Hook with its blunt edge is used to dissect and pull out the connective tissue strands and later can be cauterized and divided. Dissection is simplified by countertraction and traction. Other options are to use a cautery scissors or a spatula. Look for any bleeding and bile leak from the bed of gall bladder and the ducts. Inspection of this region would be difficult if the gall bladder is fully dissected from the liver bed.

Irrigation with normal saline is routine to check for any residual bleeding and to wash if there is any bile leak followed by suctioning. Direct suctioning at the site where the clips are applied should be avoided as it may lead to the slippage of the clips applied to the cystic duct and artery stumps. After securing perfect hemostasis, the gall bladder is dissected completely from its attachments with the liver bed.

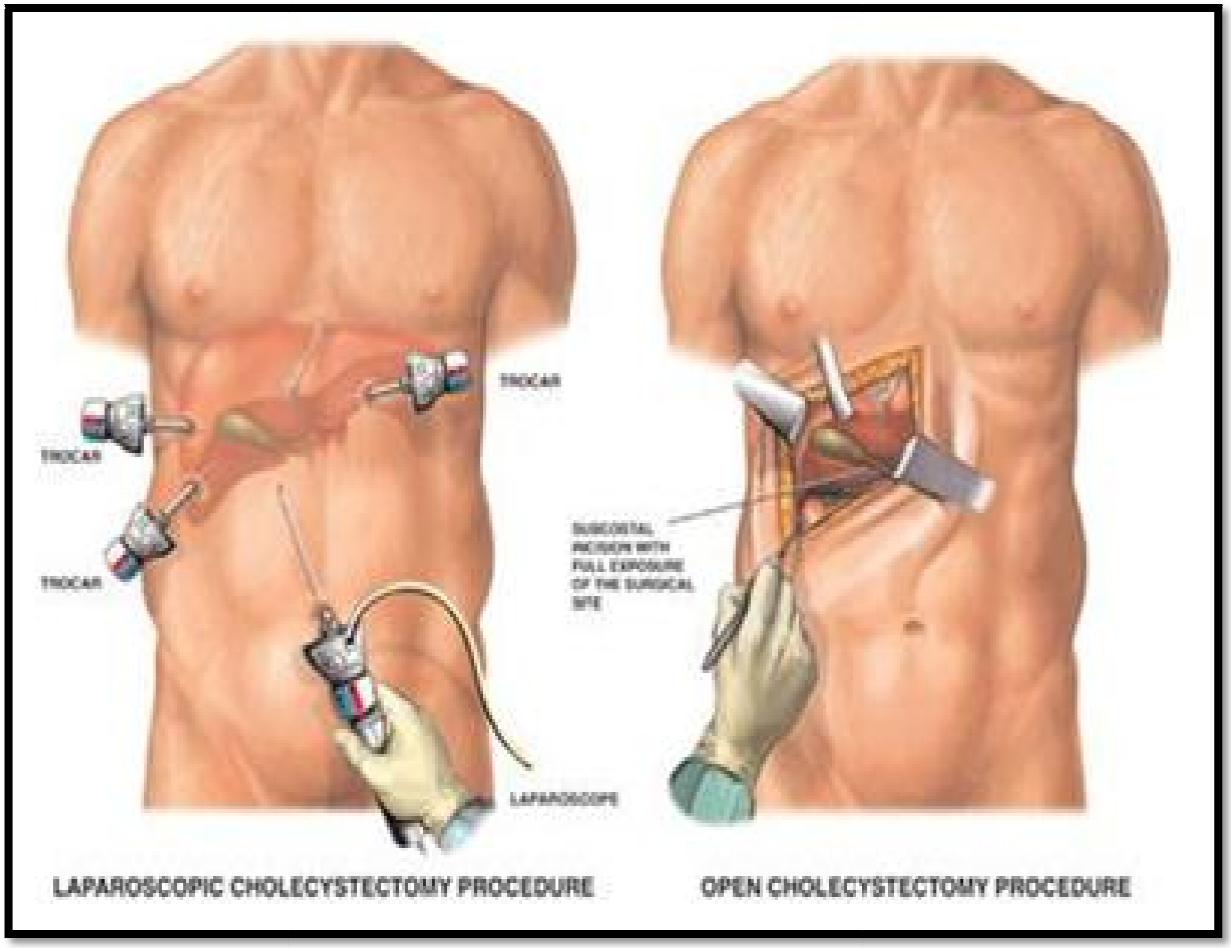
The resected gall bladder specimen is collected in an endo bag and retrieved using a grasper passed through a 10 mm trocar and is taken out from the abdomen. Some surgeons prefer retrieving the gall bladder specimen directly without using an endobag. This method of specimen retrieval should be avoided in cases where there is evidence of empyema or carcinoma gall bladder.

The gall bladder specimen is cut open after bringing out of the abdominal cavity and contents are suctioned out. It is difficult to retrieve the gall bladder if there are big stones, so they are crushed followed by removal. The contents of the gall bladder should be examined to find out whether it is a single stone or multiple stones and whether they are pigmented or cholesterol stones.

Now the epigastric port is replaced to have a thorough final look at the surgical site for any suspicion of bleeding or bile leak. Irrigation followed by suctioning from the subphrenic space and other areas of the

surgical field done. Abdominal drain is placed if needed through one of the trocar sites present laterally. All the trocars are removed and wound closure done followed by wound dressing.

Figure 31: Incisions made in open & lap cholecystectomy



OPEN CHOLECYSTECTOMY SURGICAL TECHNIQUE [2]**–**

Carl Langenbuch's description of performing open cholecystectomy in 1882 have not seen much changes till now. There are a few incisions through which open cholecystectomy can be done

like right subcostal , midline or paramedian. Kocher or the right subcostal is the most preferred incision by the surgeons all over the world. Gall bladder and hepatoduodenal ligament should have proper exposure for doing a open cholecystectomy without any complications. Medial segment of left lobe of liver is retracted superiorly and hepatic flexure inferiorly. Decompression of gall bladder is done in cases of distention.

Sharp dissection is done to release the adhesions between the viscera or omentum with the gall bladder. Extensive dissection is done to identify the common bile duct and cystic artery to decrease the incidence of bile duct injuries. Curved clamps are used to hold the infundibulum and to retract it inferiorly and laterally, fundus of the gall bladder is retracted anteriorly and superiorly. for proper exposure of the Calot's triangle structures. Counter traction of the hepatoduodenal ligament caudally opens the porta hepatis leading to tension of the peritoneum covering the cystic artery and cystic duct.

Cystic duct ligation is done with caution to avoid injury, stricture to bile duct and bile leak. Cystic artery should be dissected and ligated close to the gall bladder surface. If the surgeon feels the necessity intraop cholangiography is done. Dribbling of bile into the peritoneal

cavity should be decreased. Placement of abdominal drain is not compulsory unless the operating surgeon feels the need for it.

Complications during open cholecystectomy usually occur due to uncontrolled bleeding, extensive inflammation and injury to the portal structures, hepatic artery and common bile duct due to variations in their anatomy. Dissection should be done with utmost caution in cases of patient's who have short cystic duct ,cystic artery and right hepatic artery. After resecting the gall bladder from the liver bed, irrigation and suction of the subhepatic space done. Operated wound site closed in layers.

SUBTOTAL CHOLECYSTECTOMY[1,2] **–**

Gall bladder excision when done incompletely or partially, is a procedure rarely indicated but used wisely. It is indicated in particular conditions where severe inflammation of the gall bladder occurs in cases of severe cirrhosis , portal hypertension, gangrenous cholecystitis and when there is a scarred partially intrahepatic gall bladder. Subtotal cholecystectomy is done to prevent the risk of injuring the right portal pedicle unexpectedly and to prevent liver bed bleeding.

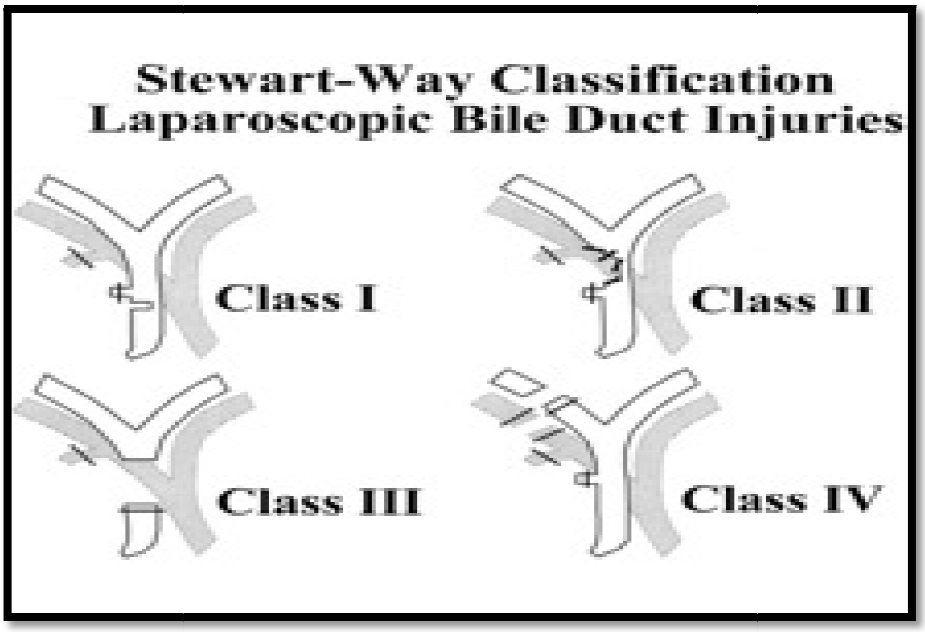
COMPLICATIONS OF LAPAROSCOPIC CHOLECYSTECTOMY[1,2,6] **–**

- Bile Leak
- Hemorrhage
- Wound infection
- Injury due to trocar / veress needle
- Ileus
- Spillage of gall stones
- Retained stone in Common Bile Duct
- Deep vein thrombosis
- Pancreatitis
- CBD injury with / without stricture
- Conversion to open cholecystectomy

BILE DUCT INJURY –

Bile duct injuries are usually seen during gastric, gallbladder and pancreatic surgeries. 80 to 85 % of the bile duct injuries occur during laparoscopic cholecystectomy. Incidence is twice more when compared to open cholecystectomy (0.3 open to 0.6 lap). Bileduct injuries can lead to complex health problems due to bile leak or bile duct obstruction.

Identification of bileduct injury is usually done intraop or immediate postop. Symptoms of bile leak is usually seen in the first postop week. It is confirmed by constant draining of bile through surgical drains, laparoscopic port sites or from the wound site. Patient's complain of nausea, rise in body temperature, diffuse abdominal pain leading to complications like peritonitis. Due to the onset of jaundice liver function tests shows signs of obstruction. Common bile duct injuries which are classified under Strasberg E are usually identified intra operatively. (**Figure 32)**



Bile duct injuries which are not identified in the first post operative week have recurring abdominal pain and features of cholangitis. Jaundice may not present as soon as the bileduct injury occurs.In patients with Strasberg B and C, that is in cases of isolated sectorial

right duct lesions and some partial stenosis , patients present with itching, abdominal pain, raised body temperature and malaise. Clinical course of bile duct injury if diagnosed late leads to chronic liver disease, portal hypertension, cirrhosis. Then liver transplantation will be the treatment of choice .

- Strasberg A injury – Treated easily by endoscopic procedures or by insertion of T- tube.
- Strasberg B injury – Cholangitis is generally medically managed .In cases of moderate to severe cholangitis percutaneous drainage or surgical resection is the treatment of choice. Long termprognosis is poor in these patients.
- Strasberg C injury – Endoscopy cannot be performed in these patients. Abdominal drains can be used for external drainage. If it's not possible go for percutaneous drainage or liver resection.
- Strasberg D injury – In this closure of the injured site is sufficient. We can use abdomen drains or can go for sphincterotomy. Surgery is the last option if Strasberg D injury worsens to E injury.
- Strasberg E injury – Good hepatojejunal anastomosis is needed and it can be done if IV and V segments of liver are partially resected, as it provides proper identification of bileducts. In

patients who are considered for Kazai portoenterostomy, liver transplantation is a better choice.

Figure 33 : Hanover classification of bile duct injury

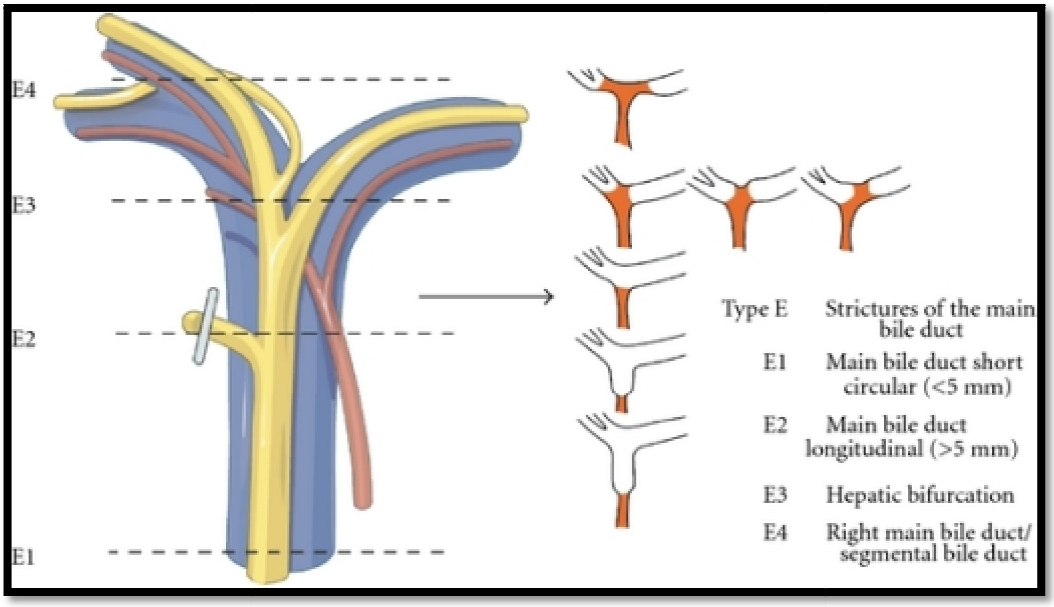
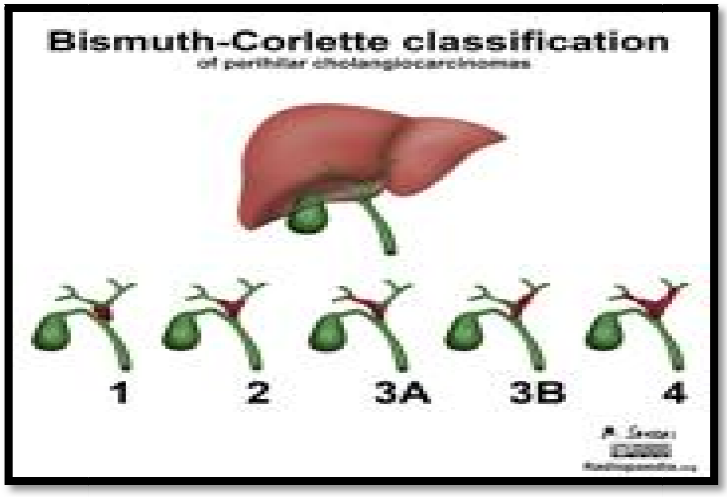


Figure 34 : Bismuth – Corlette classification



SINGLE INCISION LAPAROSCOPIC CHOLECYSTECTOMY[2,13] **–**

The rationale behind introducing Single incision laparoscopic surgery [SILS] is to decrease trauma induced by surgery during its access and to achieve a scarless surgery. Introduction of this procedure dates back to 1997 when trans – umbilical approach is used. In this method a single access device is used through which three to four instruments can be introduced through the umbilicus using a single opening.

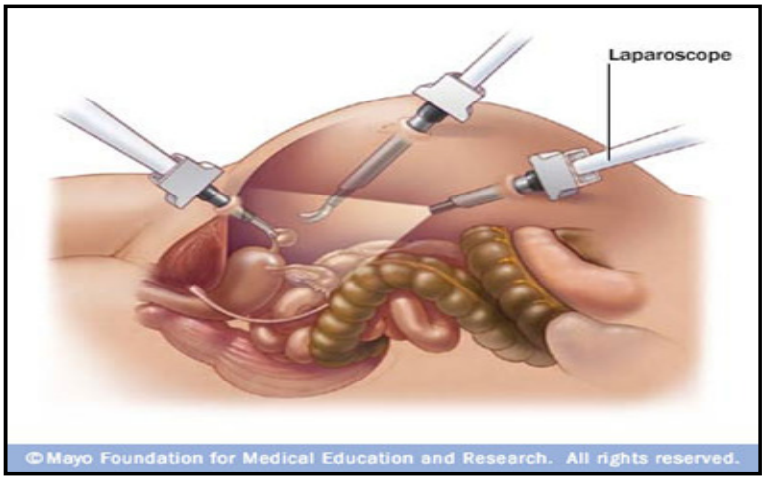
Figure 35 SPLC

SINGLE PORT LAPAROSCOPIC DEVICE

Unlike the routine multiport laparoscopic cholecystectomy in which four to five ports are placed in the abdomen in different quadrants.

Figure 36 : Port placement in multiport lap cholecystectomy

MPLC



PROCEDURE OF SPLC –

It is a single port and single incision technique using a device called X- cone.

X- cone allows usage of one optic and three hand instruments from the same port. Keeping in mind the critical view of safety a large window is always created. Moreover X- cone can be reused.

The same standards are applied for both laparoscopic cholecystectomy (which is being done for the past decade) and single incision approaches.

VARIOUS CAUSES FOR DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY

Gallbladder stones with an incidence of 10-15% is the most common cause for gallbladder disease. Statement released by National Institute of Health consensus development quoted that 'effective treatment for symptomatic gallstones in most patients is laparoscopic cholecystectomy[14].

In study conducted by Prashant S. Dhanke et al, patients who are posted for lap cholecystectomy were examined clinically in detail. Information like age, history of prior admission in hospital, gender, BMI, stone impaction, thickened gallbladder wall, per abdominal findings like scar below and above the umbilicus, and feeling of gallbladder on palpation, pericholecystic fluid collection in ultrasound abdomen[14].

The above details are used to calculate a scoring method to evaluate the difficulty in doing lap cholecystectony. Scoring method includes < 5 being easy lap cholecystectomy, 6- 10 being difficult and

scores between 11-15 very difficult. They scored various factors as age > 5 , Male gender – 1 , Prior history of hospital admission – 4 , BMI between 25.1 to 27.5 – 1 & > 27.5 – 2 , Scar below the umbilicus – 1 & above umbilicus – 2 , Gallbladder wall thickness > 4 mm – 2 , Palpable gallbladder – 1, evidence of pericholecystic fluid collection – 1, Impacted gallbladder stone – 1. Total maximum score of 15 [14].

Figure 37 & 38 : Scoring System

Table 2: Easy/difficult criteria for laparoscopic cholecystectomy as suggested by Randhawa and Pujahari [7]

Factors	Easy	Difficult	Very difficult
Time taken (min)	<60	60-120	>120
Bile/stone spillage	-	+	+
Injury to duct/artery	-	+ duct only	+
Conversion to open cholecystectomy	-	-	+

Table 1: Scoring factors based upon history, clinical, and sonographic findings [7]		
Scoring factors	**Score**	**Maximum score**
History		
Age (years)		
<50	0	1
>50	1	
Sex		
Female	0	1
Male	1	
Previous history of hospitalization		
No	0	4
Yes	4	
Clinical		
Body mass index		
<25	0	2
25.1–27.5	1	
>27.5	2	
Abdominal scar		
No	0	2
Infraumblical	1	
Supraumblical	2	
Palpable gallbladder		
No	0	1
Yes	1	
Sonography		
Wall thickness		
Thin	0	2
Thick >4 mm	2	
Pericholecystic collection		
No	0	1
Yes	1	
Impacted stone		
No	0	1
Yes	1	
Total maximum score: 15		

Difficult or easy lap cholecystectomy depended on bile leak and spillage of stones, injury to common bile duct and cystic artery and on conversion to open. In this study factors like thickened gallbladder wall,

presence of impacted stone and pericholecystic fluid, high BMI and past history of hospital admissions are important in predicting difficult lap cholecystectomy[14].

In this study BMI , previous history of hospital admission, thickened gallbladder wall, gallbladder was palpable, stone impaction and evidence of fluid around the gallbladder are found to be statistically significant. While the other factors were not found to be significant[14].

In a study conducted by Jaskiran S. Randhawa , past history of hospital admissions, BMI > 27.5 kg/sq.m , palpable gallbladder, gallbladder wall thickness of > 4mm were significant statistically. Preoperative scoring technique is useful in predicting difficult lap cholecystectomy preoperatively[7].

According to study conducted by Gurkan Yetkin et al[15] –

- Male patients are more prone to have difficult lap cholecystetomy than females because , male patients with cholecystitis have thick fibrosed bands covering the Calot's triangle and area surrounding the gallbladder when compared to females. The exact cause being unknown.

- Likewise chances of undergoing difficult lap cholecystectomy increases with age because of more episodes of cholecystitis in the past and due to prolonged history of gallstones
- Difficult surgery in obese individuals is due to problems encountered during instrument usage , liver retraction, ill defined anatomy and problems during trocar placement.
- Unlike other studies which showed difficult surgery in diabetics, due to extensive inflammatory changes seen in acute cholecystitis , this study had no correlation between diabetes and difficult surgery. Researchers explained that due to peripheral and autonomic neuropathy in diabetic patients there is delayed onset of symptoms till it becomes severe, leading to delayed diagnosis and increased chance of difficult surgery.
- In patients with history of upper abdominal surgeries due to the earlier adhesions there will be complications during trocar placement dissection of gallbladder. But Lipman et al suggested that adhesions due to acute cholecystitis will be more difficult to deal with than adhesions caused by upper abdominal surgeries and history of upper abdominal surgery did not elevate the risk of conversion.
- In his study pericholecystic fluid is formed due to the fluid translocation when gallbladder gets inflammed extensively.

- Inflammed gallbladder causing elevated leucocyte counts and fever can also contribute for difficult lap cholecystectomy .But these factors are not included in this study.

Simopoulos et al study showed that difficult lap cholecystectomy in cases of acute cholecystitis due to pathology in gallbladder is because of empyema gallbladder , hydrops and acute edematous cholecystitis[15].

Lal et al found that ultrasound findings of gallbladder can be useful for predicting difficult lap cholecystectomy.

Karam Kamal Younis et al conducted study showed that BMI more than 35, male gender, history of previous upper abdominal surgeries are significant preop predictors statistically for difficult lap cholecystectomy[16].

Suryawanshi Pravin.R et al conducted a study in which he gave different scores for ultrasound findings to predict difficult lap cholecystectomy preoperatively[8].

Figure 39 : Ultrasound scoring system

USG Total score- 20	Acute cholecystitis	3
	Empyema	3
	Thick wall (more than 3 mm	3
	Portal hypertension with periportal cavernoma	3 5
	Cirrhosis of liver	3

Schrenk et al and Fried et al studies showed that recurrent episodes of cholecystitis, excess weight, male gender, age > 65 and thick gall bladder wall have more risk of conversion to open cholecystectomy[4].

Some researchers found out that due to impaction of stone at Hartman's pouch , catching the gallbladder was difficult for dissection. Contracted and dense gallbladder due to the surrounding adhesions to the Calot's triangle will be difficult to dissect[4].

According to Hutchinson, Liu and Kama et al significant risk factor in the conversion of lap to open cholecystectomy is thickened gallbladder wall. Preoperative ultrasound screening of gallbladder is important in diagnosing the pathology and anatomy of biliary tree[17].

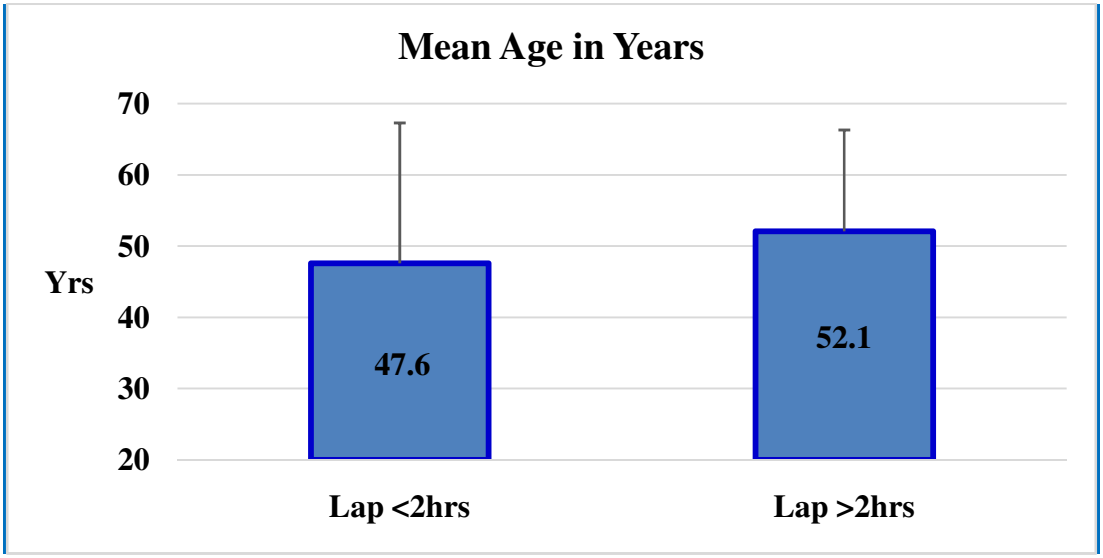
RESULTS

Study population includes 50 patients who underwent cholecystectomy by either laparoscopic or open method who are admitted in the department of General Surgery, PSG Hospitals, Coimbatore.

Table 1 : Mean age of the patients

	Surgery Duration	
	< 2Hrs	≥ 2Hrs
Mean Age ± S.D	47.6 ± 19.7	52.1 ± 14.2
P Value > 0.05		

Figure 40 : Mean age of patients



Study population was divided into two groups, the first group consisted of patients in whom the surgery duration was less than 2 hours. Second group consisted of patients in whom the surgery took more than or equal to two hours time.

Mean age in first group was found to be 47.6 ± 19.7

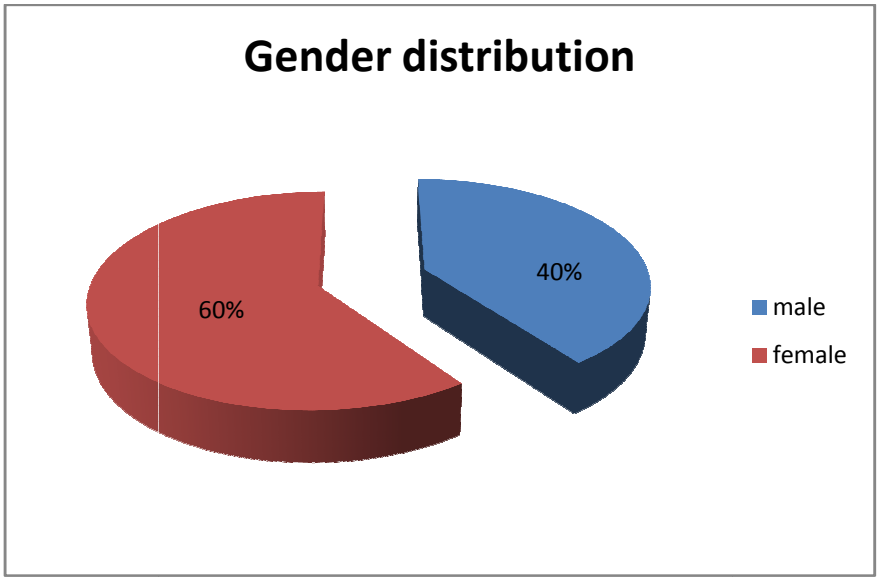
Mean age in second group was found to be 52.1 ± 14.2

The difference between the two groups was not statistically significant (p-value > 0.05) [Table 1 & Figure 40]

Table 2 : Gender distribution of cases

GENDER DISTRIBUTION OF CASES	
MEN	20 (40%)
WOMEN	30 (60%)
TOTAL	50

Figure 41 : Gender distribution of cases

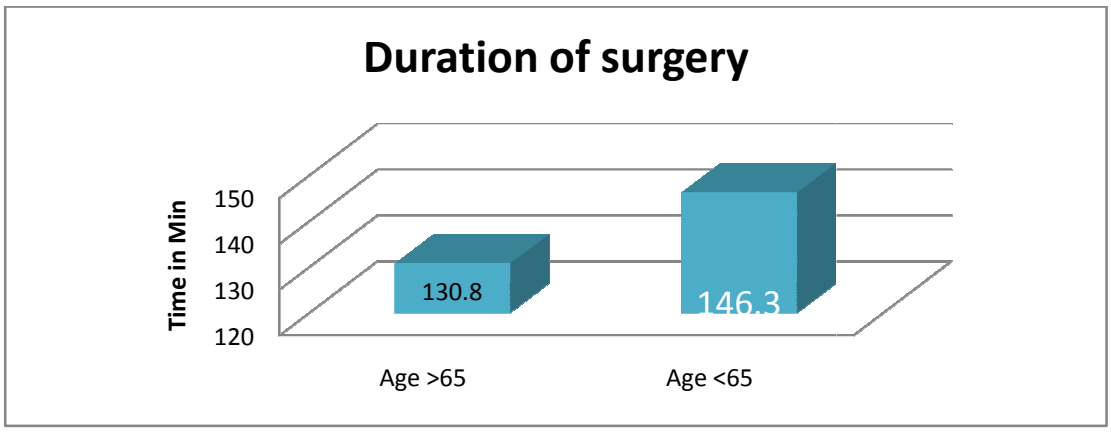


In the study population females are the predominant gender who undergone laparoscopic cholecystectomy (60%). Males account for 40% of the cases. [Table 2 & Figure 41]

Table 3 : Correlation between age & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
Age	≥ 65	12	24	130.8 ± 39.5	0.3337
	< 65	38	76	146.3 ± 50.1	

Figure 42 : Correlation between age & surgery duration

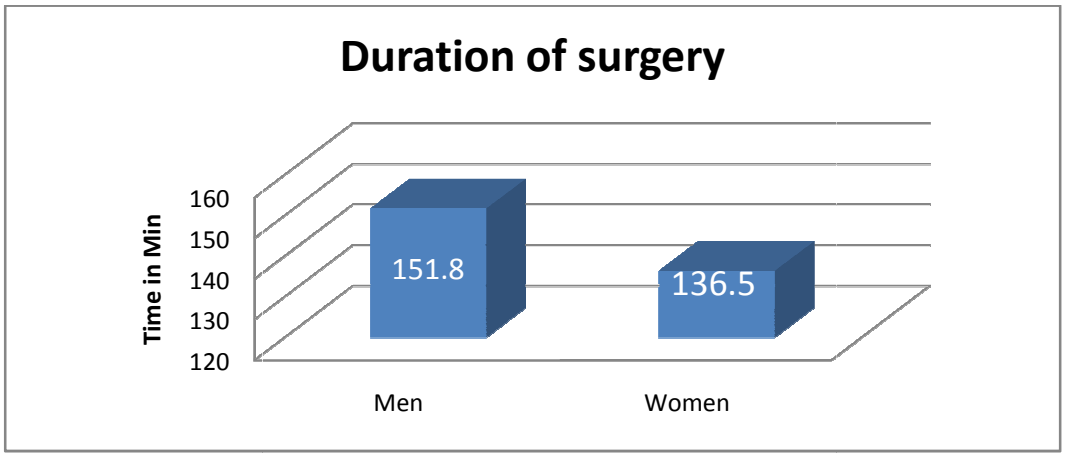


In patients with age ≥ 65 years, mean duration of surgery was 130.8 ± 39.5 minutes. In patients with age < 65 years, mean duration of surgery was 146.3 ± 50.1 minutes. The difference between the two groups was not statistically significant (p-value 0.337). Among the patients who's surgery duration was prolonged , 24% of them were within the age group of ≥ 65 years. [Table 3 & Figure 42]

Table 4 : Correlation between gender & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
Gender	Men	20	40	151.8 ± 53.9	0.274
	Women	30	60	136.5 ± 43.5	

Figure 43 : Correlation between gender & surgery duration

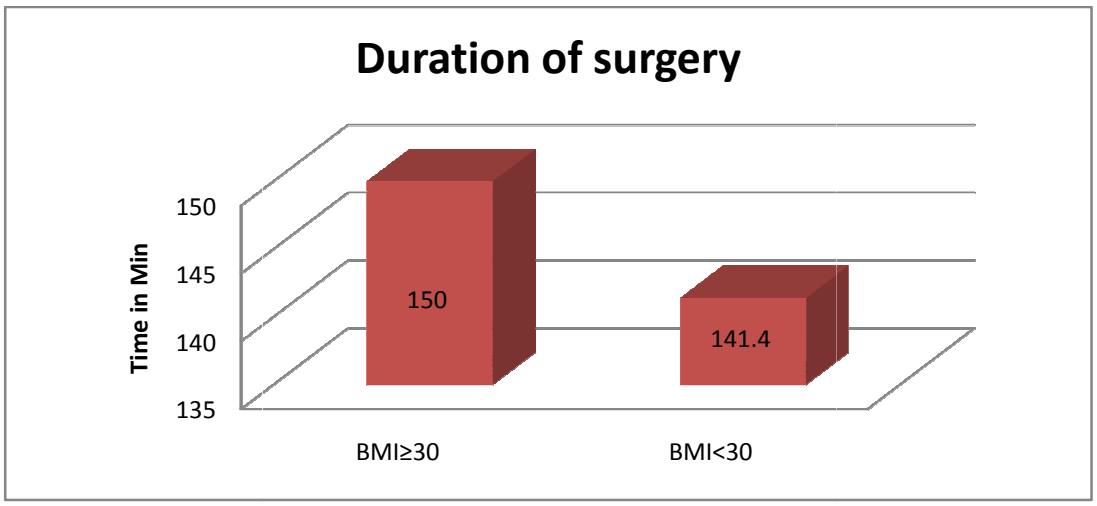


In male patients the mean duration of surgery was 151.8 ± 53.9 . In female patients the mean duration of surgery was 136.5 ± 43.5. The difference between the two groups was not statistically significant (p value – 0.274) [Table 4 & Figure 43]

Table 5 : Correlation between BMI & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
BMI	≥ 30	7	14	150 ± 39.1	0.663
	< 30	43	86	141.4 ± 49.4	

Figure 44 : : Correlation between BMI & surgery duration

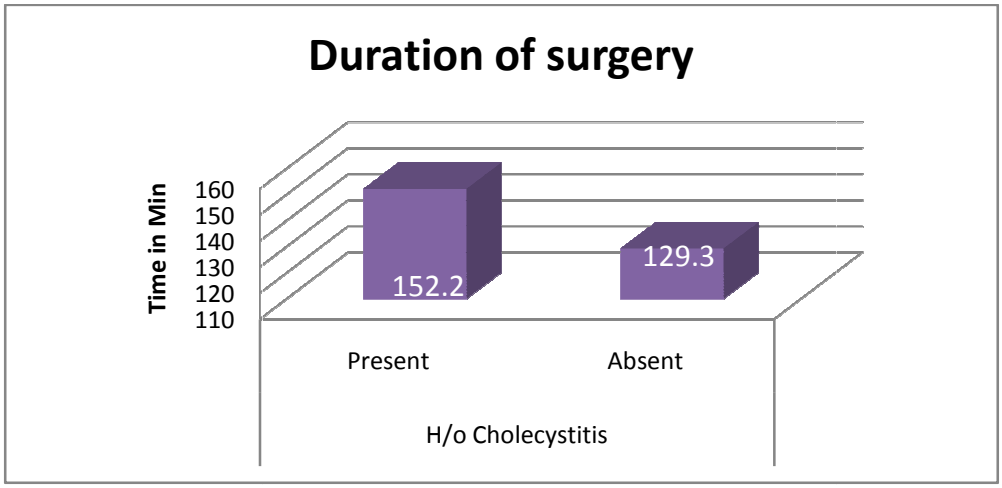


In cases with BMI ≥ 30 the mean duration of surgery was 150 ± 39.1.In cases with BMI < 30 the mean duration of surgery was 141.4 ± 49.4.The difference between the two groups was not statistically significant (p- value 0.663) [Table 5 & Figure 44)

Table 6 : Correlation between previous history of cholecystitis & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
h/o cholecystitis	Present	29	58	152.2 ± 47.6	0.094
	Absent	21	42	129.3 ± 46	

Figure 45 : Correlation between previous history of cholecystitis & surgery duration

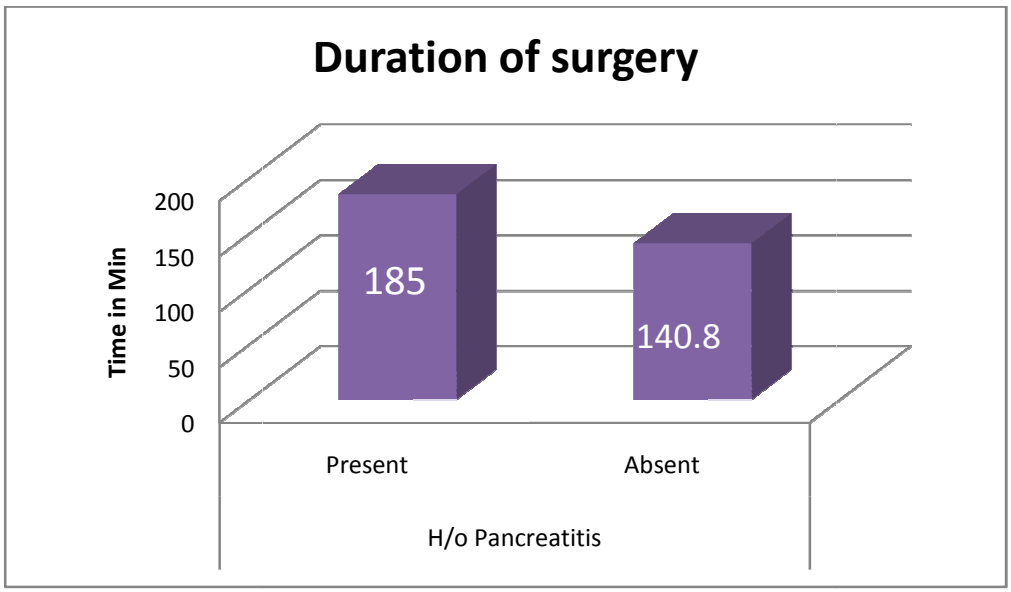


In patients with past history of cholecystitis the mean duration of surgery was 152.2 ± 47.6.In patients with no past history of cholecystitis the mean duration of surgery was 129.3 ± 46.The difference between the two groups was not statistically significant (p-value 0.094) [Table 6 & Figure 45]

Table 7 : Correlation between previous history of pancreatitis & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
h/o pancreatitis	Present	2	4	185 ± 28.3	0.204
	Absent	48	96	140.8 ± 47.9	

Figure 46 : Correlation between previous history of pancreatitis & surgery duration

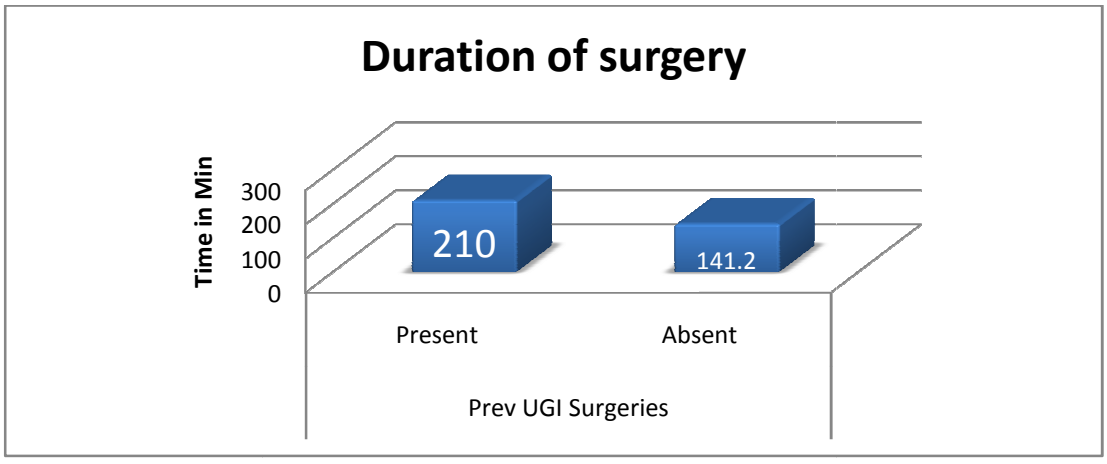


In patients with past history of pancreatitis the mean duration of surgery was 185 ± 28.3 . In patients with no past history of pancreatitis the mean duration of surgery was 140.8 ± 47.9.The difference between the two groups was not statistically significant (p- value 0.204) [Table 7 & Figure 46]

Table 8 : Correlation between previous upper abdominal surgeries & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
Prev. Upper abdominal surgery	Present	1	2	210 ± 39.1	0.156
	Absent	49	98	141.2 ± 47.3	

Figure 47 : Correlation between previous upper abdominal surgeries & surgery duration

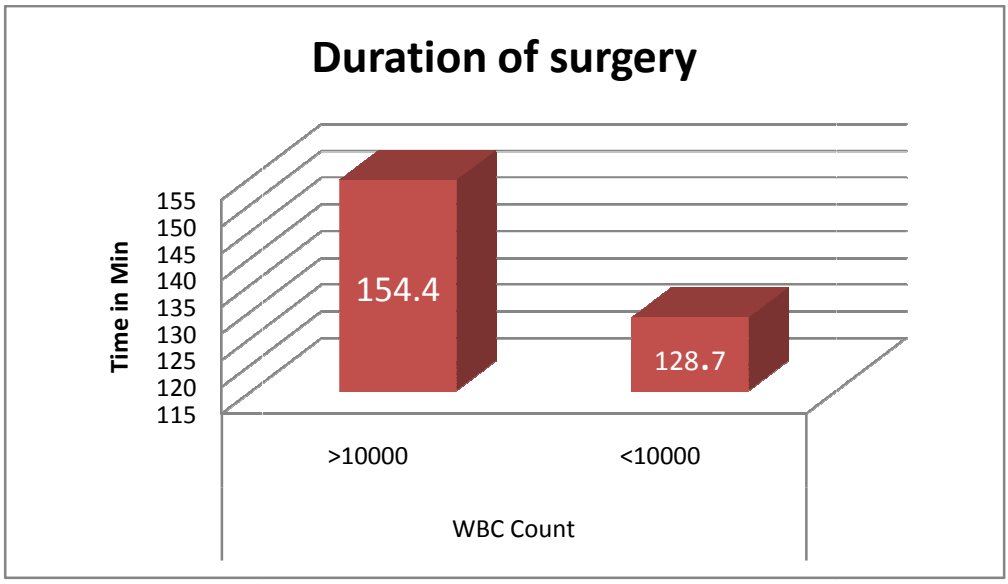


In patients with previous history of upper abdominal surgeries the mean duration of surgery was 210 ± 39.1. In patients with no previous history of upper abdominal surgeries the mean duration of surgery was 141.2 ± 47.3.The difference between the two groups was not statistically significant (p- value 0.156) [Table 8 & Figure 47]

Table 9 : Correlation between total WBC count & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
Total WBC count	≥10,000	27	54	154.4 ± 50.3	0.05
	<10,000	23	46	128.7 ± 41.6	

Figure 48 : Correlation between total WBC count & surgery duration

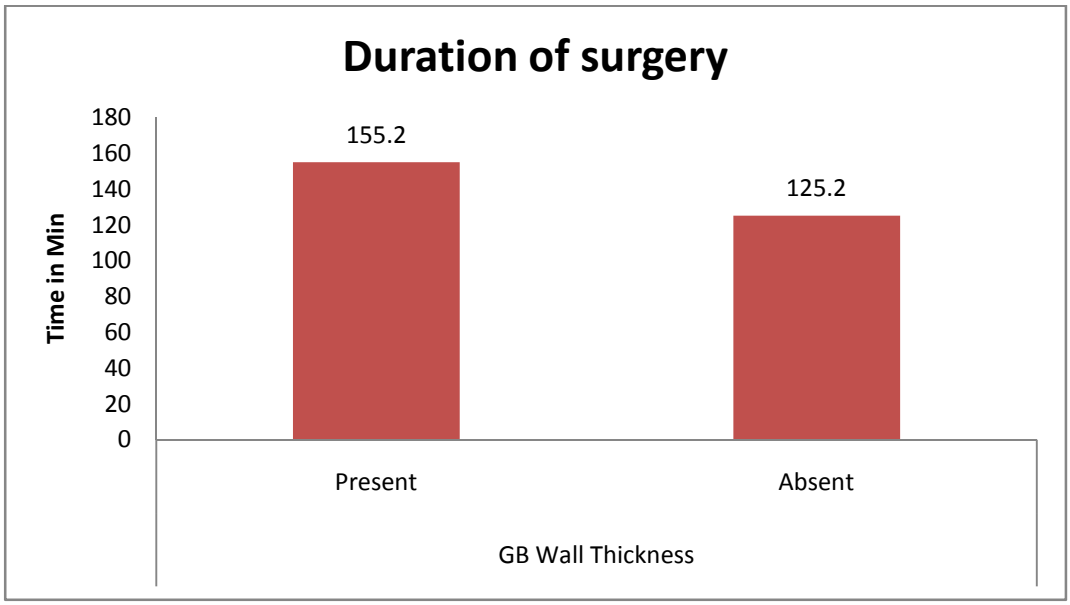


In patients with WBC count of ≥ 10,000 the mean duration of surgery was 154.4 ± 50.3. In patients with WBC count of < 10,000 the mean duration of surgery was 128.7 ± 41.6.The difference between the two groups was statistically significant (p- value 0.05) [Table 9 & Figure 48]

Table 10 : Correlation between GB wall thickness & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
GB wall thickness	Present	29	58	155.2 ± 51.9	0.027
	Absent	21	42	125.2 ± 35.9	

Figure 49 : Correlation between GB wall thickness & surgery duration

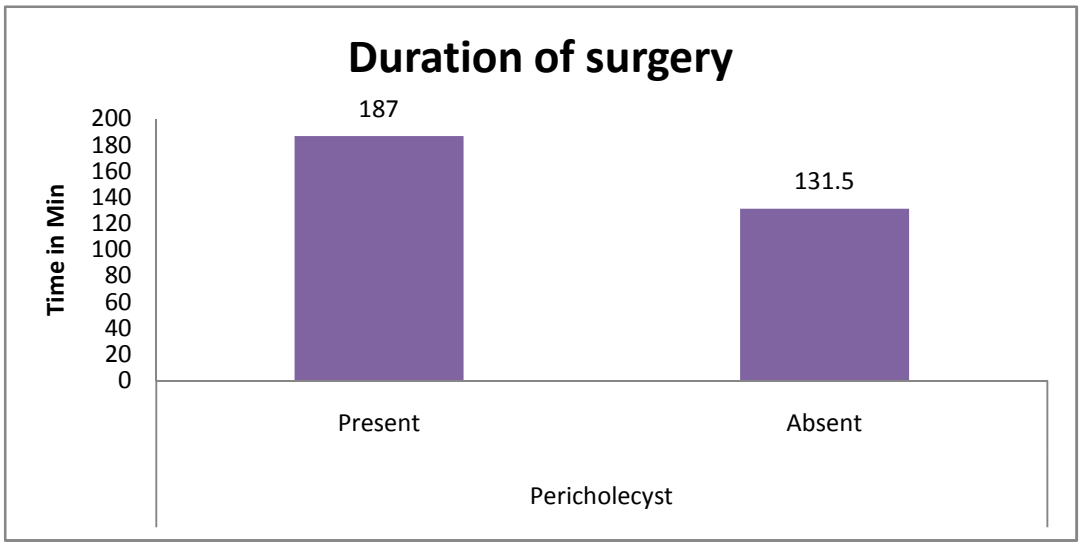


In patients who has GB wall thickness the mean duration of surgery was 155.2 ± 51.9. In patients who has normal GB wall thickness the mean duration of surgery was 125.2 ± 35.9. The difference between the two groups was statistically significant (p- value 0.027) [Table 10 & Figure 49]

Table 11 : Correlation between presence of peri cholecystic fluid & surgery duration

Pre-Operative Risk Factor		N	%	Duration	P Value
Peri cholecystic fluid	present	10	20	187 ± 63.4	< 0.01
	absent	40	80	131.5 ± 36.3	

Figure 50 : Correlation between presence of peri cholecystic fluid & surgery duration

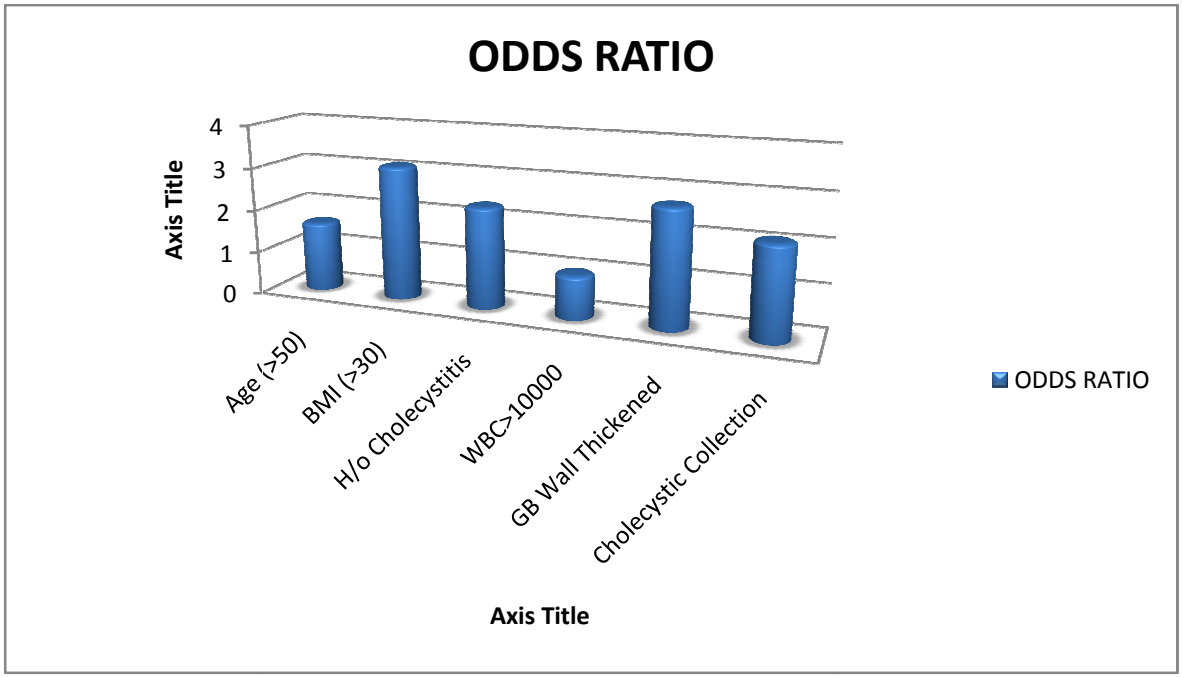


In patients who have evidence of peri cholecystic fluid the mean duration of surgery was 187 ± 63.4.In patients with no evidence of peri cholecystic fluid the mean duration of surgery was 131.5 ± 36.3.The difference between the two groups was statistically significant (p- value < 0.01) [Table 11 & Figure 50]

Table 12 : ODDS RATIO

Variable	Odds Ratio (C.I)	P Value
Age (≥65)	1.63 (0.49 - 5.39)	0.425
	Age Adjusted OR (C.I)	
BMI (≥30)	3.12 (0.34 - 28.61)	0.314
Previous H/o Cholecystitis	2.35 (0.69 - 7.97)	0.172
Previous H/o Pancreatitis	-	
H/o Previous upper abdominal surgeries	-	
WBC ≥ 10,000	1 (0.86 - 1.15)	0.968
USG Features -		
GB Wall Thickness	2.71 (0.77 - 9.57)	0.779
Peri Cholecystic Fluid Collection	2.13 (0.39 - 11.56)	0.381

Figure 51 : Odds ratio



- Patients who are > 65 years of age had 1.63 times more risk for prolongation of surgery for more than or equal to two hours when compared with <65 yrs aged patients.
- Patients whose BMI > than or equal to30 had 3.12 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients whose BMI is <30.
- Patients who had previous history of cholecystitis had 2.35 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients who had no history of cholecystitis.
- Patients who had high WBC count > or equal to 10,000 had no increased risk when compared with patients who have WBC count less than 10,000.
- Patients who had gall bladder wall thickness had 2.71 times more risk of prolongation of surgery for more than or equal to two hours when compared with patients with no gall bladder wall thickness.

- Patients who had peri cholecystic fluid collection had 2.13 times more risk for prolongation of surgery for more than or equal to two houre when compared with patients with no peri cholecystic fluid collection in ultrasound abdomen.
- All the above variables were not statistically significant (p-value > 0.05).

DISCUSSION

Laparoscopic cholecystectomy is the gold standard procedure used worldwide for treating symptomatic gallbladder disease. It replaced open cholecystectomy as the treatment of choice for gallbladder disease. Advantages of laparoscopic cholecystectomy weigh over the open procedure in many ways like significant reduction in postop pain, early oral intake and getting back to normal routine, decreased rate of postop ileus and surgical site wound complications, reduced stay in hospital, better cosmesis [5,18].

But sometimes laparoscopic cholecystectomy poses difficulties during the procedure leading to prolongation of the surgery time due to problems in creating the pneumoperitoneum, in accessing the peritoneal cavity, releasing the adhesions around the gallbladder, retrieving the gallbladder, delay if there is spillage of stone or bile and sometimes it even requires conversion to open procedure. So, it would be helpful to the operating surgeon if there are certain factors to help in predicting the difficulty of the surgery preoperatively[19].

Various studies were conducted and being conducted in which they identified certain factors predicting the difficulty of laparoscopic choecystectomy preoperatively like gender, BMI, previous history of pancreatitis, cholecystitis, upper abdominal surgeries, ultrasound findings like gallbladder wall thickness, peri choleystic fluid collection, old age and so on.

1. AGE OF THE PATIENT –

Study population was divided into two groups, the first group consisted of patients in whom the surgery duration was less than 2 hours. Second group consisted of patients in whom the surgery took more than or equal to two hours time.

Mean age in first group was found to be 47.6 ± 19.7

Mean age in second group was found to be 52.1 ± 14.2

The difference between the two groups was not statistically significant (p-value > 0.05)

In study conducted by Nabil A. Abdel Baki et al showed mean age of 42.5 ± 11.7 years. In another study conducted by Jeremy M Lipman et al showed mean age of 44.2 ± 16.8 years[5].

In patients with age ≥ 65 years, mean duration of surgery was 130.8 ± 39.5 minutes. In patients with age < 65 years, mean duration of surgery was 146.3 ± 50.1 minutes. The difference between the two groups was not statistically significant (p-value 0.337). Among the patients who's surgery duration was prolonged , 24% of them were within the age group of ≥ 65 years.

In another study conducted by Jeremy M Lipman et al found that 26.8 % patiemts with age > 65 had difficult lap cholecystectomy.

According to this study this variable was found to be statistically significant[20].

Wiebke et al conducted a study in USA in 1996 .They found that as the age increases , the chances of conversion from laparoscopy to open cholecystectomy increases[21].

2. GENDER –

In the study population females are the predominant gender who underwent laparoscopic cholecystectomy (60%). Males accounts for 40% of the cases.

Study conducted by Nabil A. Abdel Baki et al found that females are the predominant gender who underwent laparoscopic cholecystectomy (90 %). In study conducted by Jeremy M Lipman et al showed 80.7 % of the cases were females[5].

In male patients the mean duration of surgery was 151.8 ± 53.9 . In female patients the mean duration of surgery was 136.5 ± 43.5. The difference between the two groups was not statistically significant (p value – 0.274)

In study conducted by Jagdish Nachnani et al showed that male gender is one of the risk factors to predict difficult laparoscopic cholecystectomy[22].

According to study conducted by by Jeremy M Lipman et al showed 50.9 % of male patients required conversion from lap to open cholecystectomy. This was found to be significant according to the study[20].

A study conducted by Wiebke et al showed that male gender is not a risk factor for coversion of lap to open cholecystectomy[21].

Study conducted by Nabil A. Abdel Baki et al found that percentage of conversion from lap to open cholecystectomy is higher in male gender than in females. This difference was not found to be statistically significant[5].

In study conducted by Eldar S et al male gender were more prone for conversion from lap to open cholecystectomy.This was found to be statistically significant (p- value 0.0017)[23]

Serdar Y ol et al conducted a study in which inflammatory changes, fibrosis and symptomatic gallbladder stones are seen extensively in men than in women, which lead to increased rate of conversion from lap to open in males than in females.

3. BODY MASS INDEX –

In cases with BMI ≥ 30 the mean duration of surgery was 150 ± 39.1.In cases with BMI < 30 the mean duration of surgery was 141.4 ± 49.4.The difference between the two groups was not statistically significant (p- value 0.663)

In study conducted by Jagdish Nachnani et al found that BMI is a significant predictor for the coversion of lap to open cholecystectomy[22].

Study conducted by Nabil A. Abdel Baki et al showed BMI may be a risk factor in conversion of lap to open cholecystectomy [5](p- value 0.634)

4. PAST HISTORY OF CHOLECYSTITIS –

In patients with past history of cholecystitis the mean duration of surgery was 152.2 ± 47.6.In patients with no past history of cholecystitis the mean duration of surgery was 129.3 ± 46. The difference between the two groups was not statistically significant (p-value 0.094)

According to study conducted by Nabil A. Abdel Baki et al, in was 55.46 ± 10.99.In patients with no past history of cholecystitis the mean

duration of surgery was 48.32 ± 8.83.The difference between the two groups is statistically significant (p- value 0.03)[5].

Wiebke et al found that past history of cholecystitis is a risk factor in the conversion of lap to open cholecystectomy[21].

In study conducted by Jagdish Nachnani et al ,past history of cholecystitis is the most common reason for conversion from lap to open cholecystectomy due to inability to delineate the anatomy[22].

According to study conducted by by Jeremy M Lipman et al ,in people with past history of cholecystitis , 49.1 % were converted from lap to open cholecystectomy (p- value < 0.001)[20]

5. PAST HISTORY OF PANCREATITIS –

In patients with past history of pancreatitis the mean duration of surgery was 185 ± 28.3 . In patients with no past history of pancreatitis the mean duration of surgery was 140.8 ± 47.9.The difference between the two groups was not statistically significant (p- value 0.204)

In study conducted by Jagdish Nachnani et al ,past history of pancreatitis is the most common reason for conversion from lap to open cholecystectomy due to inability to delineate the anatomy[22].

6. PAST HISTORY OF UPPER ABDOMINAL SURGERIES –

In patients with previous history of upper abdominal surgeries the mean duration of surgery was 210 ± 39.1. In patients with no previous history of upper abdominal surgeries the mean duration of surgery was 141.2 ± 47.3.The difference between the two groups was not statistically significant (p- value 0.156)

Wiebke et al found that patients with past history of upper abdominal surgeries is a risk factor in conversion of lap to open cholecystectomy[21].

In study conducted by Jagdish Nachnani et al history of previous upper abdominal surgery is a predictor for difficult laparoscopic cholecystectomy as difficulties might arise during adhesiolysis, creation of pneumoperitoneum and while gaining ample exposure to the operating field[22].

7. TOTAL WBC COUNT –

In patients with WBC count of $\geq$ 10,000 the mean duration of surgery was 154.4 ± 50.3. In patients with WBC count of $<$ 10,000 the mean duration of surgery was 128.7 ± 41.6.The difference between the two groups was statistically significant (p- value 0.05)

According to study conducted by by Jeremy M Lipman et al ,in people with elevated WBC counts , 36.6 % were converted from lap to open cholecystectomy (p- value < 0.001)[20]

8. GALLBLADDER WALL THICKNESS –

In patients who has GB wall thickness the mean duration of surgery was 155.2 ± 51.9. In patients who has normal GB wall thickness the mean duration of surgery was 125.2 ± 35.9. The difference between the two groups was statistically significant (p- value 0.027)

According to study conducted by by Jeremy M Lipman et al ,in people with thickened gallbladder wall, 40.1 % were converted from lap to open cholecystectomy (p- value < 0.001)[20]

In study conducted by Jagdish Nachnani et al ,increased gallbladder wall thickness is the most common reason for conversion from lap to open cholecystectomy due to inability to delineate the anatomy[22].

9. PRESENCE OF PERICHOLECYSTIC FLUID –

In patients who have evidence of peri cholecystic fluid the mean duration of surgery was 187 ± 63.4.In patients with no evidence of peri cholecystic fluid the mean duration of surgery was 131.5 ± 36.3.The difference between the two groups was statistically significant (p- value < 0.01)

Suryawanshi Pravin. R et al conducted study 6.5 % of cases who had peri gallbladder collection had difficult lap cholecystectomy[8].

According to Lipman et al 19.6 % of patients who required conversion from lap to open had fluid collection around the gallbladder, which was statistically significant[20].

ODDS ratio:

- Patients who are > 65 years of age had 1.63 times more risk for prolongation of surgery for more than or equal to two hours when compared with < 65 yrs aged patients.
- Patients whose BMI > than or equal to30 had 3.12 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients whose BMI is < 30.

  Study conducted by Jagdish Nachnani et al showed that there was 4.26 times more risk of prolongation of surgery in obese patients when compared to non obese patients[22].
- Patients who had previous history of cholecystitis had 2.35 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients who had no history of cholecystitis.

According to study conducted by Jagdish Nachnani et al, there was 4.39 times more risk for prolongation of surgery in patients with previous history of acute cholecystitis[22].

- Patients who had high WBC count > or equal to 10,000 had no increased risk when compared with patients who have WBC count less than 10,000.

  According to Lipman et al there was 3.0 times more risk of prolongation of surgery in patients with elevated WBC counts when compared to patients with normal WBC counts[20].

- Patients who had gall bladder wall thickness had 2.71 times more risk of prolongation of surgery for more than or equal to two hours when compared with patients with no gall bladder wall thickness.

  Study conducted by Jagdish Nachnani et al found that there was 3.8 times more risk of prolongation of surgery in patients who had thickened gallbladder wall in ultrasound findings[22].

- Patients who had peri cholecystic fluid collection had 2.13 times more risk for prolongation of surgery for more than or equal to two houre when compared with patients with no peri cholecystic fluid collection in ultrasound abdomen.

Study conducted by Lipman et al found that there was 2.36 times more risk of prolongation of surgery in patients who had fluid around the gallbladder in ultrasound examination[20].

- All the above variables were not statistically significant (p-value > 0.05).

LIMITATIONS OF THE STUDY –

It was a relatively small study , larger sample size is needed to confirm these findings.

CONCLUSIONS

- Preoperative findings of Gallbladder wall thickness more than or equal to 3mm , total WBC count more than or equal to 10,000ceells/cu.mm and presence of peri cholecystic fluid collection can help in the prediction of difficult laparoscopic cholecystectomy .
- Other factors like old age (≥ 65 years), male gender , past history of cholecystitis and pancreatitis, history of upper abdominal surgeries and BMI ≥ 30 were not helpful in predicting difficult laparoscopic cholecystectomy preoperatively.

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ABBREVATIONS

1. GB	**:**	**Gallbladder**
2. LC	**:**	**Laparoscopic cholecystectomy**
3. OC	**:**	**Open cholecystectomy**
4. WBC	**:**	**White blood cell**
5. BMI	**:**	**Body mass index**
6. MPLC	**:**	**Multiport laparoscopic cholecystectomy**
7. SPLC	**:**	**Singleport laparoscopic cholecystectomy**

LIST OF FIGURES

LIST OF TABLES

DATA COLLECTION SHEET

Name of the Patient :

Age :

Sex :

Address :

Date of surgery :

Indication for Surgery :

History of previous Pancreatitis / Cholecystitis : Yes / No

History of previous upper abdominal surgery : Yes / No ; If Yes- details

Body Mass Index :

Total WBC Count :

Ultrasound Abdomen Findings : 1) Gall bladder wall thickness

2) Pericholecystic fluid collection

Conversion to Open Cholecystectomy : Yes / No

Study Volunteer ID:
Study Volunteer Name:

PSG Institute of Medical Science and Research, Coimbatore
Institutional Human Ethics Committee
INFORMED CONSENT FORMAT FOR RESEARCH PROJECTS

(strike off items that are not applicable)

I , DR YAMINI PRIYADARSHINI ADUSUMILLI, am carrying out a study on the topic "PRE-OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY" as part of my research project being carried out under the aegis of the Department of General Surgery

(*Applicable to students only*): My research guide is: DR S RAJESH KUMAR

The justification for this study is: Considering the increasing acceptance of laparoscopic cholecystectomy as the procedure of choice for symptomatic gall bladder disease, pre-operative prediction of difficult laparoscopy is essential for patient selection and prevention of complications.

The objectives of this study are:

Primary Objective: TO OBSERVE WHETHER THE FOLLOWING FACTORS ARE ASSOCIATED WITH CONVERSION OF LAPAROSCOPIC CHOLECYSTECTOMY TO OPEN CHOLECYSTECTOMY:
BMI , GENDER, PREVIOUS HISTORY OF ACUTE PANCREATITIS/CHOLECYSTITIS, PAST H/O UPPER ABDOMINAL SURGERY, GALL BLADDER WALL THICKNESS.

Secondary Objective: TO OBSERVE WHETHER THIS ASSOCIATION IS USEFUL IN PREPARING THE SURGEON TO PREDICT THE LIKELIHOOD OF CONVERSION OF LAPAROSCOPIC CHOLECSYTECTOMY TO OPEN SURGERY

Sample size: 50

Study volunteers / participants are (specify population group & age group): Patients above the age of 15 years with symptomatic gall bladder disease.

Location: PSG HOSPITALS, COIMBATORE

We request you to kindly cooperate with us in this study. We propose collect background information and other relevant details related to this study. We will be carrying out:

Initial interview (specify approximate duration): 15 minutes.

Data collected will be stored for a period of 5 years. We will use the data as part of another study (IF NEEDED).

Clinical examination (Specify details and purpose): NA

Blood sample collection: Specify quantity of blood being drawn: NA.

No. of times it will be collected: NA

Whether blood sample collection is part of routine procedure or for research (study) purpose:
1. Routine procedure 2. Research purpose
Specify purpose, discomfort likely to be felt and side effects, if any: NA

Whether blood sample collected will be stored after study period: NA

Whether blood sample collected will be sold: NA

Whether blood sample collected will be shared with persons from another institution: NA

Medication given, if any, duration, side effects, purpose, benefits: NA

Whether medication given is part of routine procedure: NA

Whether alternatives are available for medication given: NA

Final interview (specify approximate duration):_____NA____ mts. If photograph is taken, purpose: NA

Benefits from this study: FINDINGS LEARNT THROUGH THIS STUDY WILL AID IN BETTER PRE-OPERATIVE DECISION MAKING REGARDING PROCEDURE OF CHOICE WHICH CAN BE APPLIED IN TERMS OF PATIENT COUNSELLING & ANTICIPATION OF CONVERSION TO OPEN CHOLECYSTECTOMY.

Risks involved by participating in this study: NONE

How the results will be used: Study will be submitted to Dr. MGR medical university as thesis in post graduate course in general surgery.

If you are uncomfortable in answering any of our questions during the course of the interview / biological sample collection, you have the right to withdraw from the interview / study at anytime. You have the freedom to withdraw from the study at any point of time. Kindly be assured that your refusal to participate or withdrawal at any stage, if you so decide, will not result in any form of compromise or discrimination in the services offered nor would it attract any penalty. You will continue to have access to the regular services offered to a patient. You will NOT be paid any remuneration for the time you spend with us for this interview / study. The information provided by you will be kept in strict confidence. Under no circumstances shall we reveal the identity of the respondent or their families to anyone. The information that we collect shall be used for approved research purposes only. You will be informed about any significant new findings - including adverse events, if any, – whether directly related to you or to other participants of this study, developed during the course of this research which may relate to your willingness to continue participation.

Consent: The above information regarding the study, has been read by me/ read to me, and has been explained to me by the investigator/s. Having understood the same, I hereby give my consent to them to interview me. I am affixing my signature / left thumb impression to indicate my consent and willingness to participate in this study (i.e., willingly abide by the project requirements).

Signature / Left thumb impression of the Study Volunteer / Legal Representative:

Signature of the Interviewer with date: Witness:

Contact number of PI: 9791524248
Contact number of Ethics Committee Office: 0422 2570170 Extn.: 5818

ஒப்புதல் படிவம்

தேதி :

Dr. யாமினி பிரியதர்ஷினி அருமல்லி, ஆய நான் பி. எம் ஜி. மருத்துவக் கல்லூரியின் பொது அறுவை சிகிச்சை துறையின் கீழ் **"கேட்ராக்டோபி மூலம் பித்தப்பை அற்றுதல் கடினம் உள்ளவர்களுக்கு அறுவை சிகிச்சைக்கு முன்பான தீர்மானத்தில்"** என்ற தலைப்பில் ஆய்வு மேற்கொள்ள உள்ளேன்

என் ஆய்வு வழிகாட்டி: Dr. S. ராஜேஷ்குமார்

ஆய்வு மேற்கொள்வதற்கான அடிப்படை:

கேட்ராக்டோபி க் கோலிசிஸ்டெக்டமி அறுவை சிகிச்சையின் பயன்பாடு அதிகரித்துள்ள இக்காலகட்டத்தில் அறுவை சிகிச்சைக்கு முன்பே கடினமான கேட்ராக்டோபியை கண்டுபிடிப்பினை தவிர்ப்பது முக்கியமானதாகும்

ஆய்வின் நோக்கம்

பித்தப்பை தொடர்பான பிரச்சனைகளுக்கு கேட்ராக்டோபி மூலம் பித்தப்பை அற்றும் முறியினை மக்கள் அதிகமாக நாடுவதால் அறுவை சிகிச்சையின் முன்பே எந்தெந்த நோயாளிகளுக்கு இந்த சிகிச்சையை செய்வதற்கு கடினமாக இருக்கும் என்பதை உத்தேசித்து கொள்ளும் நோயாளிகளை தேர்ந்தெடுப்பதற்கும் அறுவை சிகிச்சையின் பின்விளைவுகளைத் தடுப்பதற்கும் மிகவும் உறுதுணையாக இருக்கும்

நோக்கங்கள்

முதன்மை

கேட்ராக்டோபி மூலம் பித்தப்பை அற்றுதல் முறையானது திறந்த அறுவை சிகிச்சையாக மாறுவதற்கு பின்வரும் காரணிகளுடைய தொடர்பு கண்டறியப்பட வேண்டும்

- உடல்பருமன்
- பாலினம்
- முன்பே கண்ட / பித்தப்பை கோளாறு உள்ளவர்கள்
- முன்பே வயிற்றில் அறுவைசிகிச்சை மேற்கொண்டவர்கள்
- பித்தப்பை வீக்கம்

இரண்டாம் நிலை நோக்கம்

மேற்கூறிய காரணிகளின்தொடர்புகளை ஆய்வுகளால் மருத்துவரால் முன்பே இருக்கு திறந்த அறுவைசிகிச்சை முறை தேவைப்படலாம் என்பதை கணிக்க முடிகிறதா?

ஆய்வில் பங்கு பெறும் நபர்களின் எண்ணிக்கை: 50

ஆய்வு மேற்கொள்ளும் இடம் பி. எம் ஜி. மருத்துவமனை கோயம்பத்தூர்.

ஆய்வின் படிவங்கள்

- நோயாளிகளுக்கு அறுவை சிகிச்சையைப் பற்றிய தெளிவான விளக்கம் அளிக்கப்படுகிறது

- மருத்துவரையும் பின் விளைவுனை எதிர்நோக்குதற்கும் ஏன் கோலிசிஸ்டெக்டமி செய்ய வேண்டிய நிலை ஏற்படலாம் என்பதை உணர்தற்கும் தயாராக்குகிறது

இந்த ஆய்வில் கிடைக்கும் தகவல்கள் 5 ஆண்டுகள் பாதுகாக்கப்படும் இவை வேறு எந்த ஆய்விற்கும் பயன்படுத்தப்பட மாட்டாது எந்த நிலையிலும் உங்களைப் பற்றிய தகவல்கள் யாருக்கும் தெரிவிக்கப்படமாட்டாது அவை இரகசியமாக வைக்கப்படும்

இந்த ஆய்வில் பங்கேற்க ஒப்புக்கொள்வதால் எந்த விதமான பயனும் உங்களுக்கு கிடைக்காது எந்த நேரத்தில் வேண்டுமானாலும் ஆய்விலிருந்து விலகிக்கொள்ளும் உரிமை உங்களுக்கு உண்டு ஆய்விலிருந்து விலகிக்கொள்வதால் உங்களுக்கு அளிக்கப்படும் சிகிச்சையில் எந்த விதமாற்றமும் இருக்காது

இந்த ஆராய்ச்சிக்காக உங்களிடம் சில கேள்விகள் கேட்கப்படும்

மேலும் இந்த ஆய்வில் பங்கு கொள்வது உங்கள் சொந்த விருப்பம் இதில் எந்த விதக் கட்டாயமும் இல்லை நீங்கள் விரும்பப் பட்டால் இந்த ஆய்வின் முடிவுகள் உங்களுக்குத் தெரியப் படுத்தப்படும்

ஆராய்ச்சியாளர் கையொப்பம் :
தேதி :

ஆய்க்குட்படுபவரின் ஒப்புதல்

நான் இந்த ஆராய்ச்சியின் நோக்கம் மற்றும் அதன் பயன்பாடுகளைப் பற்றி தெளிவாகவும் விளக்கமாகவும் தெரியப்படுத்தப் பட்டுள்ளேன் இந்த ஆராய்ச்சியில் பங்கு கொள்ளவும் இந்த ஆராய்ச்சியின் மருத்துவ ரீதியான குறிப்புகளை மற்றும் காகித ஆவணங்களை பயன்படுத்திக் கொள்ளவும் முழுமனதுடன் சம்மதிக்கிறேன்

ஆய்க்குட்படுபவரின் பெயர், முகவரி :

கையொப்பம்
தேதி :
சட்டப்பூர்வமாக அதிகாரப்பட்டவர்:

ஆராய்ச்சியாளரின் தொலைபேசி எண் 9791524248
மருத்துவ நெறி முறைக் குழு அலுவலகத்தின் தொலைபேசி எண் 0422 2570170
Extn.: 5818

s.no	OP No	IP No	Age	Gender	BMI	h/o cholecystitis	h/o pancreatitis	prev UA Surgeries	WBC Cou	GB wall thickness	peri cholecystic collection	TIME	procedure
1	O14007574	I14007017	79	M	25.37	Y	N	N	6.1	Y	Y	180 min	LAP
2	O14018026	I14007119	45	M	19.92	Y	N	N	13	Y	N	120 min	LAP
3	O14019612	I14007716	53	M	23.4	Y	N	N	10.5	Y	Y	270 min	LAP
4	O14020826	I14008328	47	F	24.46	Y	N	N	11.15	Y	N	210 min	LAP
5	O14021596	I14008590	49	M	32.51	N	N	N	5.9	Y	N	145 min	LAP
6	O14021230	I14008438	41	M	22.05	Y	N	N	15	Y	N	90 min	LAP
7	O14021057	I14008796	50	F	24.07	Y	N	N	10	N	N	165 min	LAP
8	O14022305	I14008997	60	F	25.51	N	N	N	7.2	Y	Y	230 min	OPEN
9	O14022251	I14009091	36	F	20.16	Y	N	N	9.9	N	N	110 min	LAP
10	O14022531	I14009111	70	F	30.95	Y	N	N	12.6	N	N	120 min	LAP
11	O14022760	I14009143	35	F	24.16	Y	Y	N	12.3	Y	N	165 min	LAP
12	O14022659	I14009300	42	F	49.7	N	N	N	8.6	N	N	105 min	LAP

13	O14022204	I14008960	69	M	20.23	Y	Y	N	16	Y	Y	205 min	LAP
14	O14024031	I14009710	63	M	26.17	N	N	N	9.9	N	N	110 min	LAP
15	O14024618	I14009940	54	M	22.8	Y	N	N	6.6	Y	Y	180 min	LAP
16	O14007287	I14010071	50	F	28.37	Y	N	N	5.9	Y	N	150 min	LAP
17	O1402576	I14010279	53	M	22.52	Y	N	N	10.7	Y	Y	220 min	LAP
18	O14025373	I14010425	62	M	21.75	N	N	N	6.5	Y	N	120 min	LAP
19	O09095892	I14012637	78	M	24.26	N	N	N	6.3	N	N	90 min	LAP
20	O04048866	I14013545	75	F	30	Y	N	N	21.6	Y	N	150 min	LAP
21	O12061204	I14013967	23	F	20	N	N	N	18.1	Y	Y	65 min	LAP
22	O14024770	I14014700	39	F	28.23	Y	N	N	6.9	Y	N	155 min	LAP
23	O14034363	I14014602	58	F	21.6	Y	N	N	11.8	N	N	150 min	LAP
24	O14034377	I14014601	70	M	23.12	N	N	N	14.7	Y	N	105 min	LAP
25	O14037537	I14015862	34	M	25.34	Y	N	N	11.4	N	N	155 min	LAP

26	O14037866	I14015960	55	M	20.13	Y	N	N	11.5	Y	Y	210 min	LAP
27	O11053498	I14015997	40	F	23.17	N	N	N	8.1	N	N	120 min	LAP
28	O10051421	I14016599	32	F	23.61	Y	N	N	12.2	Y	Y	90 min	LAP
29	O14039858	i14016867	30	F	22.66	Y	N	N	7.6	Y	N	105 min	LAP
30	O14038561	I14016980	52	M	23.63	N	N	N	9.6	N	N	60 min	LAP
31	O14042130	I14017872	27	F	20.33	N	N	N	9.1	Y	N	80 min	LAP
32	O14031623	I14018035	32	F	21.73	Y	N	N	12.5	Y	N	100 min	LAP
33	O13028209	I14018461	52	M	24.84	Y	N	N	6.8	Y	N	120 min	LAP
34	O14042958	I14019088	82	F	26	Y	N	N	8.3	N	N	60 min	LAP
35	O14044411	I14019039	38	F	25.95	N	N	Y	11.8	Y	N	210 min	OPEN
36	O14045320	I14019276	64	M	26.5	Y	N	N	6.8	N	N	180 min	LAP
37	O11069040	I14020192	47	F	30.59	N	N	N	7.2	Y	N	180 min	LAP
38	O14026527	I14020527	45	F	35.42	N	N	N	7.1	N	N	130 min	LAP

39	O14049614	I14020870	70	F	28.45	N	N	N	10.1	N	N	110 min	LAP
40	O14050249	I14021119	70	M	23.65	Y	N	N	13	Y	N	140 min	LAP
41	O14017446	I14024792	34	F	28.39	Y	N	N	10.4	Y	N	135 min	LAP
42	O14060653	I14025431	70	F	19.92	N	N	N	31.5	N	N	160 min	LAP
43	O14062180	I14025301	47	F	25	Y	N	N	12	Y	N	150 min	LAP
44	O14044396	I14025871	55	F	24.4	Y	N	N	9	N	N	110 min	LAP
45	O13043669	I14025986	35	F	29.68	N	N	N	10	N	N	120 min	LAP
46	O1406360	I14025950	39	F	30.47	Y	N	N	12.8	Y	Y	220 min	LAP
47	O14061890	I14025840	18	M	21.24	N	N	N	10.4	N	N	210 min	LAP
48	O14026072	I14013209	70	F	27.08	N	N	N	7.7	N	N	125 min	LAP
49	O14029427	I14013196	29	F	18.76	N	N	N	9.7	N	N	115 min	LAP
50	O08044362	I14026492	65	M	22.3	N	N	N	10.3	N	N	125 min	LAP